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VOLUME XVIII. FEBRUARY, NINETEEN HUNDRED. NUMBER 2.

THE RELATION OF RESERVOIRS TO PARKS.

Frederick Law Olmsted, Jr.

The wasteful methods of administration in our large cities form a well-worn subject of discussion; but I think that the amount of money and energy wasted merely through the lack of intelligent co-operation between different parts of the municipal organization is seldom realized. It is to one form of this waste that I wish to call attention; namely, to the incomplete returns which are usually secured for municipal expenditures upon reservoirs. Not that I mean to imply that reservoirs are generally constructed extravagantly or inefficiently with regard to their main purpose: I mean that they might generally be made to serve another purpose in addition without in the least degree impairing them as reservoirs, thus securing a double return on the investment. All reservoirs, except those small enough to be covered, have, in addition to their essential quality of storing water, an element of landscape effect; namely, that of an expanse of clear, sparkling water. This same element forms the chief feature of many landscapes in public parks, where it is created at large cost, and it is clearly a thing of great value to the public when it can be made available.

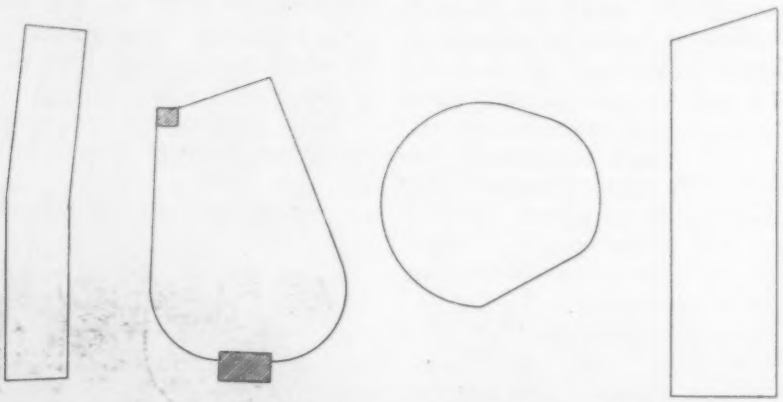


FIG. 1.—OUTLINES OF RESERVOIRS, STIFF, BUT FORMAL.

In itself, regardless of its outline or setting, a body of water is beautiful and refreshing, and its value to the public is so well recognized that provision is very often made

for giving the public access to the enclosure about a reservoir, whence its surface may be seen. But the inherent beauty of a sheet of water, due to the reflected colors of the sky, to the quality of surface given by the ripples, and to the motion of the waves, is but a small part of

FIG. 2.—42D STREET RESERVOIR, NEW YORK.

the beauty which can be secured by combining the water with other elements of landscape into a general composition. The surface of a good building stone is beautiful in itself for color and texture, yet the stone gives greater enjoyment when its beauty of color and texture are absorbed in the general effect of a beautiful building, where the flat surfaces are given proper form, setting, and contrast by other elements of the design. Similarly, the refreshment and recreation to be derived from a sheet of water, as such, is but a small part of that given by a lake or basin in which the water has such a frame or setting as to bring out its full value as an element of landscape.

My point is, that if the considerations which control the wise expenditure of city money upon park lakes were given due, though subordinate, weight, in the planning of municipal reservoirs, the public would get more for its money.

Where a reservoir occurs in a public park, as frequently happens, it might often be made to add largely to the value of the park instead of striking a discordant note, and where a reservoir occurs in its own enclosure it might often be made so to supplement the park system as to overcome the need for an additional park, to the manifest advantage of the tax-payers.

It is only fair to say, however, that it is not always because of entire disregard of æsthetic considerations that the water of a reservoir lacks a proper setting. There are generally certain peculiar difficulties in securing a pleasing result, and further, because of the very lack of co-operation between Water Board and Park Commission, an engineer is generally left unaided to deal with a side of the problem for which his training and experience have given him no special preparation. It is not reasonable to expect men whose whole time and energy have been devoted to the study and solution of the difficult problems of hydraulic engineering to treat successfully the

FIG. 3.—42D STREET RESERVOIR, NEW YORK.

utterly different problems of landscape design, even though their intentions and desires be the very best. Fairness to the engineers responsible for water-works, as well

as proper regard for the interests of the public, demands that they should be given the help of trained designers of landscape in constructing reservoirs just as much as that they should be given the help of architects in building pumping-stations. Some pumping-stations are designed by hydraulic engineers, but the fact is in most cases painfully apparent, and the practice is not now in high esteem. The sort of genius who can design a beautiful building or plan a park without previous training or practice is very rare, even among the ablest hydraulic engineers. It is for this reason especially that there should be co-operation between the experts advising park commissions and those in charge of reservoirs.

FIG. 4.—BASIN AT THE VILLA D'ESTE.

It is of distributing reservoirs, rather than of outlying collecting basins, that I shall speak especially, as it is the former which are most accessible to large masses of population, and it is they also which are apt to be more artificial in character, more difficult to treat, and more ugly in appearance when completed. A collecting reservoir is generally situated in a natural valley, and frequently the only markedly artificial feature about it is a short dam at its lower end.

A distributing reservoir, on the other hand, is generally placed on high ground near the population to be served, and is largely retained by artificial dykes. It is the locations of such reservoirs on high ground, where the surrounding frame of landscape is necessarily limited in width, that presents the greatest inherent obstacle to their pleasing treatment. A sheet of water on the summit of a hill, with but a narrow rim of stone or earth about it, is essentially artificial; and if the hillsides be so steep or the embankment so high that an earthen margin of any considerable breadth would be very costly, any attempt to simulate a natural pond is not only unreasonable on account of cost, but is doomed to failure from the very fact of inappropriateness. The artificiality must be frankly recognized in such a case, and a thoroughly formal treatment adopted. By formal, I do not merely mean a thing of straight lines, but a thing having "form," a thing "with some shape to it," a thing with a pleasing symmetry and balance and proportion.

I have seen reservoirs—and for the matter of that water basins built solely for appearance sake—with outlines like those which follow: Artificial, truly, but to my mind utterly lacking in the qualities that would entitle them to be called, in any strict sense, formal. (Fig. 1.)

FIG. 5.—GRAND BASIN AT CHICAGO.

The disagreeable quality of all such shapes is that they suggest to the eye certain definite geometrical forms without realizing the suggestion. They disappoint the eye by their imperfections, and are thereby displeasing. To discuss the reasons why perfect geometrical forms are pleasing to the eye, or to set forth the principles of designing formal water-basins, would require much time, and both subjects have been treated by others better than I could treat them.

The only example I have at hand of a strictly architectural reservoir is one in the design of which the view of the water counted for very little—the original Croton reservoir at Forty-second street, in New York, now about to be replaced by the new public library. (Fig. 2.) The reservoir was built upon the top of a hill, where even at the time of its construction land was costly, and the width of the embankment was reduced to a minimum, while the outer side was

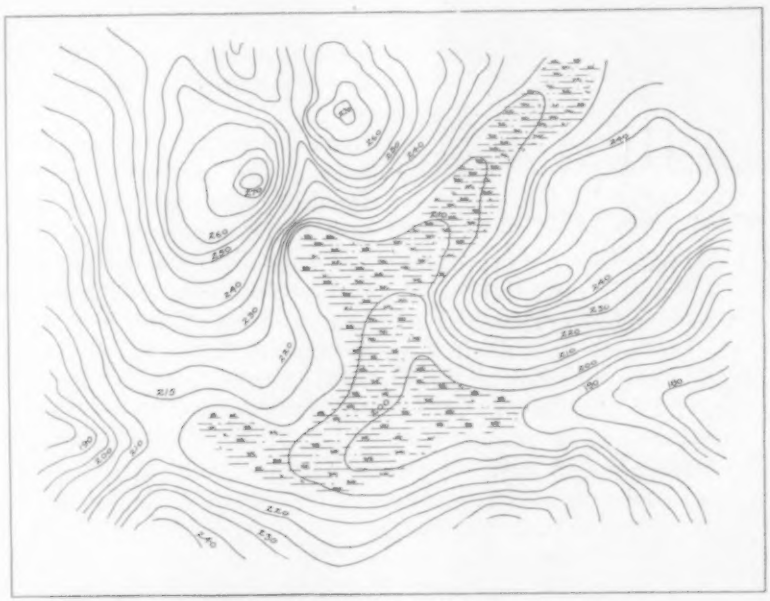


FIG. 6.—A DISTRIBUTING RESERVOIR—THE SITE.

It is sufficient to repeat that where the conditions require that a reservoir should be obviously and wholly artificial in character, its form and the treatment of its retaining banks should be formal or architectural in style. It is to be said in support of this principle that reservoirs perched upon narrow summits or with otherwise restricted embankments are generally of such limited area as to lend themselves to successful treatment in some formal manner.

formed into an interesting façade. (Fig. 3.) An interior staircase gave access to a pleasant promenade around the water. Instances of formal basins of designs more or less applicable to reservoirs might be multiplied almost indefinitely. (Figs. 4 and 5.) However, I should only be wasting time in emphasizing a principle that you must all recognize on its mere mention.

It is of reservoirs where the topography has been more favorable

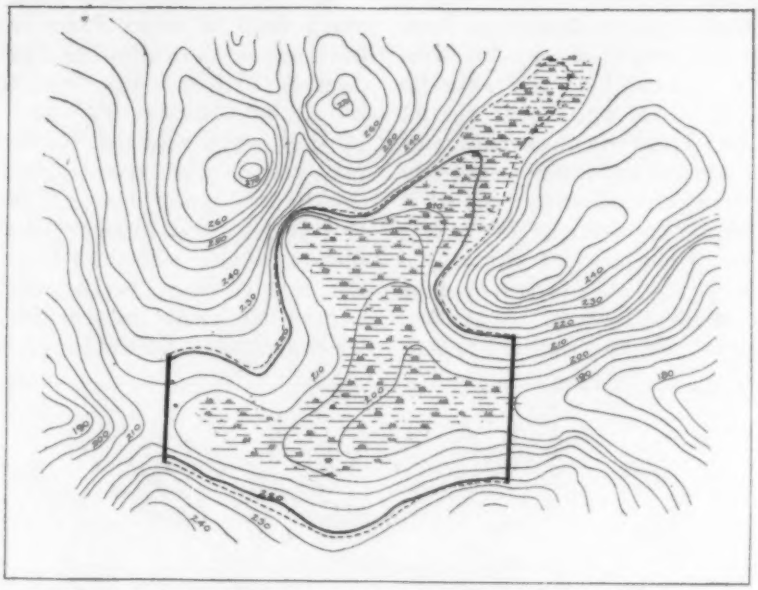


FIG. 7.—A DISTRIBUTING RESERVOIR—THE PRIMARY OUTLINE.

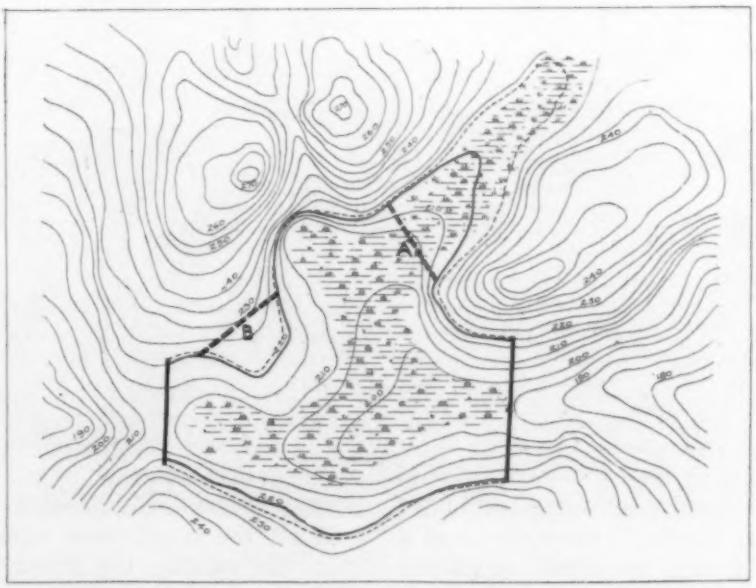


FIG. 8.—A DISTRIBUTING RESERVOIR—THE SECONDARY OUTLINE.

that I wish especially to treat, where higher land upon some sides at least has helped the engineer to form his basin and can help to frame the water with a not unnatural rim of landscape. Here the choice of treatment is more open, the opportunity for securing a pleasing effect is wider, and the chances for going astray are perhaps more numerous.

The outline of such a reservoir is usually determined in a general way at least by the natural topography, and at the points where the rim of the basin is of nature's own carving the form is apt to be irregular, interesting and seldom ungraceful; but so many changes are apt to be caused by the engineering exigencies of the case that the final shape often has qualities very different from these. To make my meaning clearer I have sketched a situation such as might be chosen for a reservoir—the head of a valley, in which a gently sloping swamp lies between the hilltops. (Fig. 6.)

In constructing the reservoir a main dam of some form must be built across the valley, and a smaller dam is further required at the low saddle between the hills at the left. If that were all, the form of the reservoir would be as indicated by the heavy black line. (Fig. 7.) But it does not answer merely to impound the water by barriers at the low places, leaving the other shores to come where the water level meets the natural surface; for, in the first place, the humus, or soil containing organic matter, must be removed from the ground to prevent defilement of the water, and the excavation of varying depths of soil may considerably change the original contours and with them the outline of the water surface.

If all the muck were excavated from the swamp, the water would meet the underlying surface thus cleaned off along the dotted line (Fig. 7), thus forming a long and rather shallow cove. Now such a

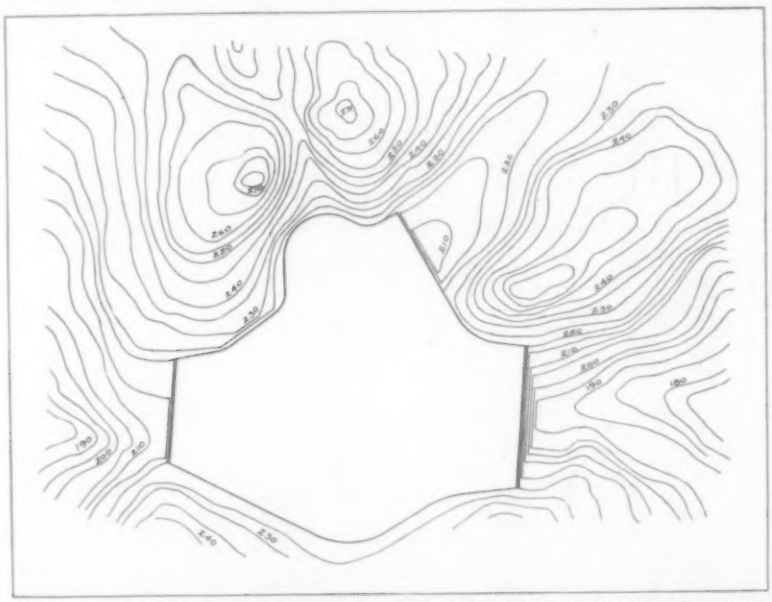


FIG. 9.—A DISTRIBUTING RESERVOIR—THE COMMON-PLACE RESULT—STIFF WITHOUT SYMMETRY, IRREGULAR WITHOUT PICTURESQUENESS.

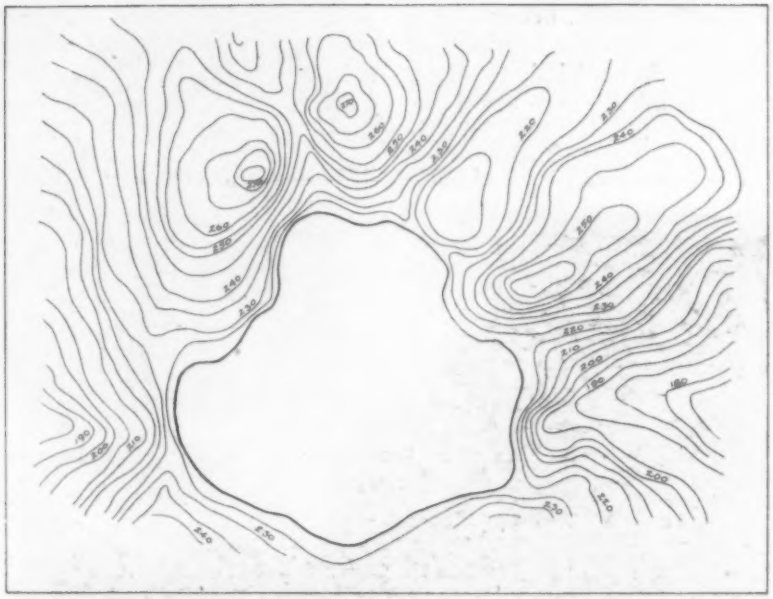


FIG. 10.—A DISTRIBUTING RESERVOIR—THE POND-LIKE POSSIBILITY.

FIG. 11.—RESERVOIR AT BROOKLINE, MASS.

cove, though picturesque, has its objections in a reservoir. Other things being equal, the deeper a reservoir is the better, because it is in shoal water that contaminating vegetable growths are likely to occur, and it is especially where the water is not much agitated by current or wind, as in a narrow cove, that these growths are apt to be most troublesome. When to this is added the cost of digging out the muck, it is obvious that the engineer instead of excavating this cove would cut it off from the reservoir by a third dyke. (A, Fig. 8.) To include the cove would increase the capacity of the reservoir very little, might give trouble by reason of its shallowness, and would be the more costly treatment.

Returning to Fig. 7, it is evident that there is another shallow place where a flat point makes out from a hill on the left. This hill is clean gravel, easy digging, and since material is needed for making the dams, the engineer excavates down to a sufficient depth. He goes back farther than the natural water-line with his cutting, because the point rises very little above the water level, and nearly every yard taken out here for use in the dams means a yard increase in the storage capacity of the reservoir, while the digging is cheaper than elsewhere. (B, Fig. 8.)

FIG. 12.—RESERVOIR AT BROOKLINE, MASS.

FIG. 13.—RESERVOIR AT BROOKLINE, MASS.

Most of the banks are now rather steep, and all of them show raw earth, which would wash into the water if left unprotected against the waves. It therefore becomes necessary to provide some form of shore protection, and to set stakes for the contractor to put it in place. Since a line composed of straight lines and circular arcs is the easiest to draw, the easiest to stake, and the easiest to define and to reproduce should the stakes be misplaced, the probability is that the engineer will have the shore line finished upon such a line: From the engineering standpoint it is natural and reasonable to do this. The reservoir will then be bounded by straight lines and circular arcs in locations approximately fixed by the natural contours and by the previously determined excavation and dyking. (Fig. 9.)

It is needless for me to say that the resulting form is unnatural. Its artificiality is glaringly obvious, whether one looks at it in plan, or on the ground comes suddenly in line with one of those long tangents. In the latter case, as one walks along the shore, his eye follows the bend of a sweeping curve seen in perspective, the bend progressing steadily before his eye as he walks, until suddenly as he comes in line

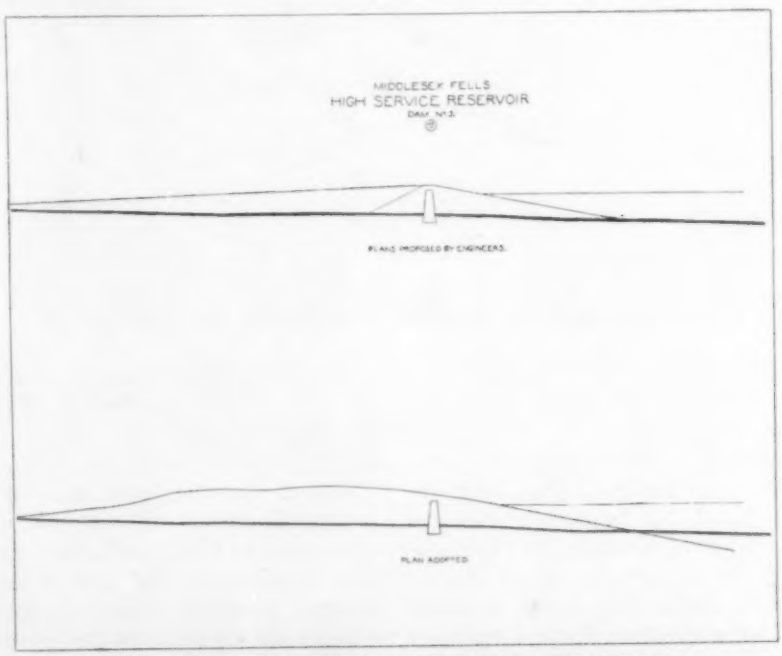


FIG. 14.—SECTIONS THROUGH A RESERVOIR EMBANKMENT.

with the tangent his eye has to change its adjusted motions and jump a quarter of a mile down an undeviating straight. It is not only a striking reminder of the artificiality of the shore, but it is in itself a disagreeable sensation. In other words, the thing is intrinsically ugly. Moreover, it is a bad mixture of motifs to apply a hard formality of execution to a general design without symmetry, balance, or any suggestion of formality. Assuming that for reasons of economy the general outline is practically fixed, it is wrong that a figure so irregular, and so lacking in any peculiar charm of form, should be defined by lines of such a precise sort that the eye can not fail to notice them, and that the attention can not fail to dwell on the shapelessness of the shape, if I may be excused the expression.

The bounding lines, on the contrary, should be so indefinite, so unprecise in character, that one may enjoy the general effect of the water surface and its relations with the adjacent masses of foliage or hill without the insistent obtrusion of its outline upon the eye. (Fig. 10.) Perhaps in a cove it may be possible to have a beach, and if so, its precise, smooth, and almost geometrical curve will serve to call attention to that particular part or the outline which has a regular shape, graceful, pleasing, and not unnatural in spite of its regularity.

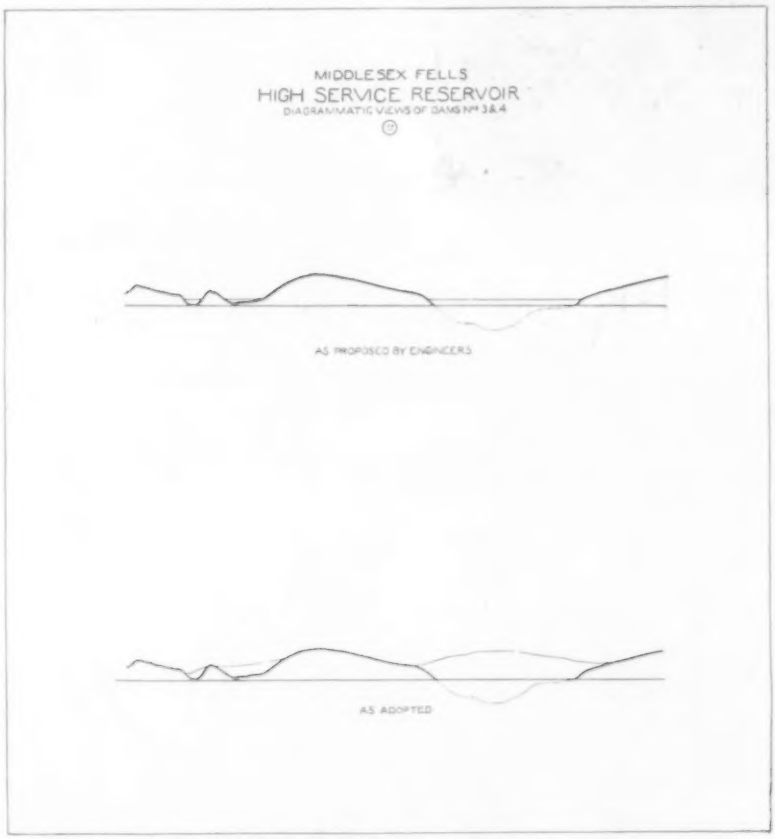


FIG. 15.—DIAGRAMMATIC VIEW OF RESERVOIR EMBANKMENT.

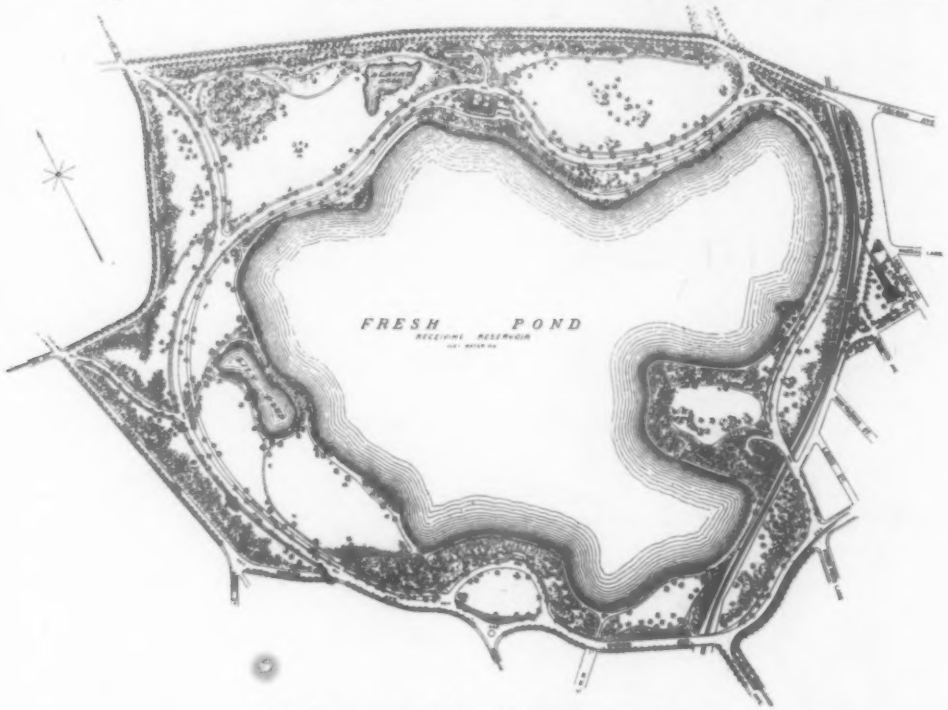
FRESH POND—ORIGINAL TOPOGRAPHY.

FRESH POND—AFTER CONVERSION INTO A RESERVOIR.

A few illustrations show the extreme definiteness and the conspicuous succession of stiff arcs and tangents that characterize so many reservoirs of which the general form is entirely irregular. (Figs. 11, 12, 13.) What I have said against the ugly combination of tangents and arcs finds some support in these views, but the ugliness of line is far more apparent when the tangent is seen on the ground in passing, and appears to snap out of the curve as one reaches it.

This may seem like foolish carping at details when compositions including these objectionable features can be as agreeable as the last; but our whole sense of enjoyment and well-being is made up of details, and though the average man may not consciously appreciate a single one of the hundred refinements of detail in a well-designed park, yet I am certain that those refinements do unconsciously affect him and send him back from a walk in the park with his nervous system more refreshed than if the refinements had been ignored in the construction of the park.

These photographs show, also, another ugly feature of the usual reservoir — its shore protection. The heavy stone revetment laid at a uniform angle of slope shows all round the shores, but its character is more conspicuous in the first of the three photographs. (Fig. 11.)



GENERAL PLAN FOR FRESH POND PARK.

As I have said, shallowness is objectionable in a reservoir, and therefore the banks below water should be steep, rather than shelving. Unfortunately a steep bank can not withstand wave action, unless it is protected by something in the nature of a pavement or riprap. It is to be borne in mind, however, that this wave action takes place only at the surface, and that if the

reservoir, as often happens with distributing reservoirs, remains very nearly at a constant height, the protection need not extend more than two or three feet below the

FIG. 16.—FRESH POND GROVE—BEFORE.

water level. While at first sight this would seem to have little bearing upon the appearance above water, it is really very important, because it makes it possible, instead of protecting a steep bank by paving, to substitute a flatter slope just at the water level,—in other words, to use a beach of gravel or sand upon which the waves can expend their force without effect

FIG. 17.—THE OUTLET OF FRESH POND.

except to shift the sand a little to and fro.

Below the zone of wave action the slope can be steep, and within the zone of wave action, especially if the beach be of sand, the constant motion will prevent all vegetable growth, for nothing is more barren than a beach of shifting sand. The formation of a beach is in fact nature's method of protecting a bank from wave action, and it is not only much more agreeable in appearance, and with its flexibility of slope and material more appropriate to a pond of irregular outline, but it is far cheaper than a granite pavement. Although there are a great many cases where this treatment is not applicable, still it might have been used about not a few reservoirs that have simply cost more and looked uglier because of applying the standard article shown in the photograph.

I give no illustration of the typical reservoir embankment. Every one knows what it is and will recognize its form in the steepest line of the accompanying sections. (Fig. 14.) The sections refer to a reservoir, now being constructed on park lands, where a large amount of muck had to be excavated in order to get the basin clean enough for reservoir purposes. As land-

FIG. 18.—THE ORIGINAL PATHWAY ALONG THE NORTH SHORE OF FRESH POND.

scape architects of the Park Commission, my firm suggested that the excavated material be used to ease off the outer slopes of the dyke, so that they should be less stiff and conspicuously artificial than usual. The engineers readily agreed and proposed sections with a uniform slope of one in ten on the outside. Even then there was a large surplus of material which the engineers proposed to dispose of by filling up an adjacent valley. The further suggestion of the landscape architects is indicated on the lower section, where the dyke is shown as rising above the absolutely necessary level into the form of an irregular ridge or hill.

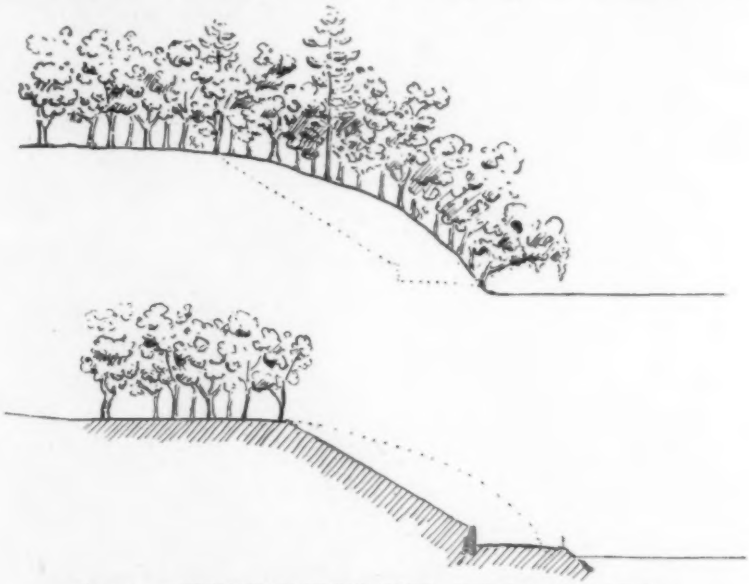


FIG. 19.—SECTIONS OF FRESH POND—BEFORE AND AFTER.

The elevation of two dykes, seen from the reservoir, shows, first, the customary level-topped dyke, as proposed by the engineers; and, second, the hill-like outline of the combined dyke and spoil bank, as proposed by the landscape architects, and as now being carried out. (Fig. 15.) There need be no suggestion of artificial dykes whatever, after the newness of the graded earth is taken off by a few years of tree growth. In fact, the effect will be that of a spring-fed pond, such as often occurs high up on New England hills and mountains.

An instructive example of a reservoir within its own park-like grounds is Fresh Pond, in Cambridge, Mass. (See map.) This was a natural glacial pond fed by springs and lying in a hollow between gravel hills, at a level scarcely above high tide.* The sketch map indicates approximately its original condition, showing the steep hills which came down to the water's edge in places, and the swamps which elsewhere formed its shores. The swamps were in general deep pockets or glacial potholes filled by the slow accumulation of vegetable matter. The hills on the south and

*Indeed, salt water at times backed in, and early in the use of the pond as a storage reservoir means had to be employed to exclude the entrance of tide-water at the natural outlet of the pond.

FIG. 20.—THE SAME BANK AFTER PLANTING.

west are high, joining with still higher land behind. Those on the east and north are lower outlying spurs, and between them the marshy outlet of Alewife Brook

FIG. 21.—FRESH POND GROVE.

meandered off through salt marshes to the Mystic River and the sea.

The only pictures I have of the original state of the pond show bits of the eastern and northern shores. The first is the eastern point of high land, known as Fresh Pond Grove, from the growth of hemlocks upon it, once a favorite picnic place much resorted to by Harvard students of an earlier generation. (Fig. 16.) The above is not quite in its natural condition in the picture, the flat margin next the water having been widened by the gradual deposit of sawdust and other matter from an adjoining ice-house.

A reproduction of an old sketch may give some suggestion of the character of the reedy marsh at the outlet of the pond. (Fig. 17.) The hill along the northern shore was covered by a growth largely of beech and birch, and at its foot ran a charming narrow path or cart-way. (Fig. 18.)

As the springs which had fed Fresh Pond were considerable, and as the storage of the pond was relatively large, and as it was near the population to be supplied, it was chosen as the first source of water supply for the city, with a steam pump to give the necessary head. Before many years it became necessary to go farther afield in order to increase the supply, but the additional water was brought by gravity to Fresh Pond, which thus became a receiving reservoir.

The bordering bogs and the shal-

FIG. 22.—FRESH POND GROVE, AND THE ROADWAY.

low portions of the pond, as might be expected, seriously injured the flavor and appearance of the water, so that the Water Board was compelled to enter upon the task of cleaning the pond and converting it in fact and appearance, as well as name, into a reservoir.

Referring to the sketch map again, we can see the shallow and boggy places at a glance. It was determined to cut off these places from the pond by cores or dykes of gravel, and gradually to fill up the bogs behind the dykes with more gravel, as time and occasion served. In order to make the pond conveniently accessible to the public it was determined to build a driveway on the top of these gravel cores, and either because it is the custom to put a road or path all the way around a reservoir exactly parallel with the shore and immediately adjacent to it, or for other reasons, the drive was so constructed in this case. (See second map.)

The usual method of tangents and arcs was used, although there are happily few long or conspicuous tangents. But perhaps the most unhappy feature of this operation was the effect of carrying the roadway past the steep, wooded headlands. Here, for the sake of economy, to avoid filling the pond, or to get material needed for other necessary fills, the road was placed wholly or partly in cut.

The upper section suggests the original condition of the hill south of the pond, which was covered with beeches, chestnuts and other trees, while the final condition appears clearly in the lower section. (Fig. 19.) These are things which speak for themselves.

FIG. 23.—FRESH POND GROVE—AFTER.

After grading, the bank was covered with turf, and to find a more obviously artificial or inharmonious bank would require some search. On the advice of the landscape architects whom the board subsequently consulted, the bank was planted with trees and bushes, but is as yet only partially covered and

without regrading can never be absolutely natural or harmonious in appearance. (Fig. 20.)

A similar case is that of Fresh Pond Grove, a picture of which in its original state is given elsewhere. (Fig. 16.) Notice, also, a photograph, taken from the opposite direction, which shows admirably the overhanging shore trees on the left, and which shows also as a narrow line along the shore to the right the advancing shore roadway. (Fig. 21.) The next picture shows

FIG. 24.—FRESH POND RESERVOIR—THE NORTHWEST SHORE.

the painful effect of its further advance, and a nearer view does not relieve the impression in the least. (Figs. 22 and 23.) In this case the destruction of scenery was not limited to what these pictures show, for the cut so dried the soil of the hill as to cause the death of a considerable part of the hemlocks not directly touched in the excavation.

Crossing to the other side o the pond, and looking toward the northern shore where ran the woods path, one sees in the middle distance a part of the dyke cutting off the northern shallow arm of the pond, known as Black's Nook. (Fig. 24.) A large part of Black's Nook has been filled, and in the distance one can see where the hills have been cut away to supply material for the filling. In a nearer view this is made plainer by the little mound left about the tree which marks the original surface. (Fig. 27.) The effort to save the tree was commendable, but the method of doing it only serves to emphasize the artificiality of the dead-level surface down to which the excavation was carried elsewhere. Even supposing that a cut had to be made here, to have left the surface slightly undulating, and with a gentle slope upward from the pond, would have added nothing to the cost of excavation and would have greatly improved the appearance. It is for making just such suggestions, which are not likely to occur to an engineer, that a landscape architect should

be taken into consultation by the builders of reservoirs sufficiently early to make the suggestions effective. It is only necessary to refer you again to the original condition of this northern shore, with its woods path, to make clear how desirable it would have been to avoid in a steep bank made the result rather uninteresting and distinctly artificial. (Fig. 26.) A section will make the process clear. (Fig. 27.) The dyke is shown cutting off from the reservoir a shallow lily pond, from which the ground runs back nearly level, partly in fill and

FIG. 25.—FRESH POND RESERVOIR—THE NORTHERN SHORE.

excavating a roadway around this part of the margin by substituting a drive at the top of the hill. (Fig. 18.)

It was upon the unwooded hills to the west and southwest of the pond that the heaviest cuts were wisely made to get material for filling the boggy places behind the dykes, but the practice of cutting down to a flat surface ending partly in cut, to the steep bank, where the excavation had stopped for the time being.

This was about the state of things when the landscape architects were called in. At their advice the remaining excavating was done in the upper part of the bank, and a part of the excavated material was used for refilling at its foot, so as to do away with the too abrupt junction

of plain and hill. (Fig. 28.) This partial section indicates rather imperfectly what was done in accordance with their advice, because the sections adopted vary greatly at different points. The roadway indicated at the foot of the slope, which is here a considerable distance from the shore, is intended as a substitute for the continuous marginal roadway, which, under the new plan, will be changed at many points into a path.

An examination of the general plan will bring out the application of a number of the principles applying to the æsthetic design of reservoirs. (See third map.) The main driveway around the pond skirts the shore in the low ground at the northeast, shown in the last photograph, then departing from it, rises to the low hill to the north of the pond, where space is provided for a hitching-place, and for a future refectory or lunching-place

FIG. 26.—FRESH POND—THE BORROW PITS.

There are several places where the construction of a roadway at the water's edge did not injure the scenery, and where its retention is entirely to be desired. (Fig. 29.) At one of these points it is intended not only to retain the roadway next the water, but to widen it by filling farther out into the pond, substituting a sand or gravel beach for the present riprap bank, thus securing breadth enough to permit the removal of the fence without suggestion of danger to those driving on the roadway. (Fig. 30.)

overlooking the pond from among the trees, while a footpath follows the shore below the hill. It will be a long time before this shore can be restored to a condition approaching what was there before the present drive was put through, but with only a path to provide for, there will be space for the necessary slopes and planting, without the heavy expense for grading which would be required to make a driveway thoroughly agreeable here. Further on, the drive will follow the edge of the filled land, but with

a more varied shore than the present, and with the footpath beside it. Leaving the edge of the reservoir, the road will swing across the meadow to the base of the hill slope, and rising gradually up its face will be far more interesting and varied than one monotonously following the arcs and tangents of the present shore without variation in horizontal or vertical distance from the shore line, while by its removal

FIG. 27.—FRESH POND—A SECTION OF BORROW PITS.

FIG. 28.—FRESH POND—PART OF FIG. 27 AS REGRADED.

reach the top of the high wooded hill on the south, where a concourse will give a beautiful outlook with a fine plunging view down upon the water. The shore is to be occupied by a path, sometimes near the water, and sometimes separated from it by a few yards of turf or bushes, but the drive will remain on the high ground all the way to the beach a the north-east. Such a drive will

FIG. 29.—FRESH POND RESERVOIR.

from the critical points the shores may be made more attractive in the views across the pond, and those on foot may here and there enjoy them in quiet without the annoyance of passing carriages.

While I can not here go into the subject of planting about reservoirs, I must mention an objection often raised to the planting of trees on reservoir banks; namely, that the leaves falling from them are injurious to the water. Certainly dead leaves are no benefit to drinking water, and if added in sufficient quantity, they will undoubtedly affect its taste and color; but when I consider that, in the opinion of experts, one of the best water-sheds is one covered with woods, where in the case of sudden rains the water of numerous surface pools containing a strong infusion of leaves is washed down over the surface into the collecting basin, while the general surface flow runs its whole course over and among the dead leaves of past seasons, I can not believe that the leaves falling into a distributing reservoir from

a few trees upon its margin can appreciably affect the water. Moreover, shrubs upon the borders of a reservoir serve as a sort of screen to catch blowing leaves, so that they actually reduce the quantity of organic matter getting into the water. If there must be a stone facing, I need not say what a vast improvement in appearance can be secured by the planting of shrubs that will overhang the stone-work while trees well placed will serve with their reflections to make the whole into a beautiful landscape.

In conclusion, let me repeat that in the design of reservoirs and reservoir grounds, which may so obviously be made to serve the two distinct purposes of holding water and acting as a park, there is likely to be a sheer waste of tax-payers' money if some one competent to design a park is not called into consultation with the hydraulic engineer responsible for the reservoir, at the very outset of his work.

FIG. 30.—FRESH POND RESERVOIR.

A REVIEW OF DECISIONS ON ASSESSMENTS FOR PUBLIC WORK.

By C. W. Tooke, Professor of Law, University of Illinois.

In the January number of MUNICIPAL ENGINEERING appeared a valuable criticism of the Norwood-Baker case from the pen of Mr. C. O. Tichenor, of Kansas City, condensed from a report submitted by him to the bar association of that city with regard to the effect of that decision on the special assessment clause of the municipal charter. Mr. Tichenor's review of the case contains a clear statement of the facts involved and his conclusions as to strict limits of the applica-

bility of the case must be sustained if we take his view that the decision is in harmony with the earlier decisions of the same court on the subject of the special assessments. But the contention that is made by several courts which have had occasion to pass upon the question of assessments by the front foot since the decision in the Norwood-Baker case is to the effect that the supreme court in that case took advanced ground, that while the decision may be in harmony with previous decisions of the same court, it lays down for the first time certain principles of construction of the powers of the states in this matter that will be followed in the future in passing on the validity of special assessment statutes. It may be worth while to review once again certain phases of the Norwood-Baker case, and to consider briefly the interpretation given to its opinion by several courts that have subsequently passed upon similar cases.

In the first place, it may be noted that, notwithstanding the provisions of the constitution of the state of Ohio, which the Norwood ordinance may have violated, and which the court incidentally recognizes, the plaintiff's suit proceeded upon the ground distinctly stated, that the assessment in question was in violation of the fourteenth amendment, providing that no state shall deprive any person of property without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws, as well as of the bill of rights of the constitution of Ohio. The court recognizes the right of the state to take the property under the exercise of the power of eminent domain, and proceeds to ask itself the question whether, in the exercise of the power of taxation, the exclusion of benefits from the estimate of compensation to be made for the property actually taken for public use authorize the public to charge upon the abutting property the sum paid for it, together with the entire costs incurred in the condemnation proceedings, irrespective of the question whether the property was benefited by the opening of the street.

In answering this question the court says: "There is a point beyond which the legislative department, even when exerting the power of taxation, may not go consistently with the citizen's right of property. As already indicated, the principle underlying special assessments to meet the cost of public improvements is that the property upon which they are imposed is peculiarly benefited, and therefore the owners do not, in fact, pay anything in excess of what they receive by reason of such improvement. But the guarantees for the protection of private property would be seriously impaired, if it were established as a rule of constitutional law that the imposition by the legislature upon particular private property of the entire cost of a public improvement could not be questioned by him in the courts of the country." * * * "In our judgment, the exaction from the owner of private property of the cost of a public improvement in substantial excess of the special benefits accruing to him is, *to the extent of such excess*, a taking, under the guise of taxation, of private property for public use without compensation."

The court, after reviewing several cases passed upon in the state court, upheld the same principle, answers the criticism that its decision is in conflict with that handed down in Parsons *v.* District of Columbia, 170

BOSTON STREET WATERING CARTS AND INSPECTORS.

U. S. 45. In that case a special assessment was levied against the lands of Parsons, situated in the District of Columbia, under the authority of a statute of congress establishing a comprehensive system of water supply for the District. One of the points raised was that the assessment exceeded the actual cost of the work. This objection, in the language of the court, overlooked "the fact that the laying of this main was a part of the *water system*, and that the assessment prescribed was not merely to put down the pipes, *but to raise a fund to keep the system in efficient repair*. The moneys raised beyond the expense of laying the pipe are not paid into the general treasury of the District, but are set aside to maintain and repair the system; and there is no such *disproportion between the amount assessed and the actual cost as to show any abuse of the legislative power.*" If the cost of laying the water mains in question in that case had exceeded the value of the property specially assessed, or had been in excess of any benefits received by that property, a different question would have been presented.

From these opinions of the court in the Norwood-Baker case it can be seen that the court has not therein decided that all assessments for public improvements by the front foot are necessarily invalid, but that they will be so considered if they are in excess of the benefit of the improvement in question to the property assessed to the extent of such excess. Further, that an attempt to assess the cost of such an improvement without taking into consideration the benefit of the improvement to the property assessed therefor will give the person aggrieved the remedy of injunction, leaving to the proper authorities, in case the assessment is found to be excessive or not in substantial compliance with the principle of assessment for benefits, the discretion of making a new assessment upon the abutting property for so much of the expense as may be found upon due inquiry to be equal to the special benefits accruing to the property. There can be no question that statutes which provide that the assessments shall be made according to the valuation of the lots abutting are valid, for they bear an analogy to the revenue laws of the state which endeavor to impose the burdens of the government upon the citizens in proportion to the value of their property. But if an ordinance proceeds upon the theory that the assessment can be made without a consideration of the special benefits accruing to the property assessed, or, in other words, levies a tax according to the front foot without regard to benefits, there can be little doubt that the ordinance will be adjudged invalid as in contravention to the provision of the fourteenth amendment. Nor will it be sufficient that the ordinance makes a provision that when sued upon the tax bill the owner will be given a chance to defend on the ground that his property was not benefited, and may thus have his claim adjudicated, for this would be in the nature of a suit at law, to which, under the statutes of most of our states, the other owners would not be parties, and the finding of the jury as to the assessment in the particular case would not apply to the other cases.

Perhaps the best example of the weight that will be given to the decision in the Norwood-Baker case is to be found in the decision of the supreme court of Texas in Hutchinson *v.* Storrie, passed down

PUSH CART PATROL IN BOSTON.

at the June term of last year (51 S. W. R. 848). In overruling the decision of the superior court in that case, Judge Brown admits that the lower court undoubtedly followed the great weight of authority by which such assessments had been previously sustained, but asserts that the previous rules have been completely overturned by the decision of the supreme court of the United States in the Norwood-Baker case. "We recognize," says the court, "the binding force of the decision of the supreme court of the United States upon this question, but we the more readily apply it because we indorse it as a timely and just announcement of the superiority of a constitutional guaranty over a rule of law established by the courts." The court thus summarizes the principles established by the Norwood-Baker case, which it deems applicable to the case at bar:

1. "The legislature of a state can not authorize a municipal corporation to assess upon abutting property the cost of an improvement in a sum materially exceeding the special benefits which that property may derive from the work."

2. "The legislature of a state can not confer upon a municipal corporation the authority to make such assessment conclusive upon the owner without giving an opportunity to contest the question of benefits."

3. "In the village of Norwood *v.* Baker, the supreme court of the United States laid down the rule that, because the assessment was made under a law that did not afford property owners the opportunity to be heard, nor empower

WASTE BARRELS AND SCAVENGERS IN BOSTON.

COMBUSTIBLE WASTE PLANT IN BOSTON—SORTING REFUSE.

the city authorities to consider the question of benefits, the assessment in that case was a nullity."

The court therefore concludes that as in the case at bar neither the city council nor the municipal officers considered the question of special benefits which might accrue to the land from the work, but proceeded upon the basis of the cost of the improvement to determine the amount, the assessment must be adjudged to be void.

In such a case one should not be guided by the desire to frame ordinances that just come within the constitutional limit, but they should always be brought within a safe margin of validity. The statute of Missouri as to apportioning the cost of repaving a street in cities of the third class on blocks and lots abutting thereon according to the front foot has already been decided to be unconstitutional by the circuit court for the southern district of Mis-

COLLECTION OF COMBUSTIBLE WASTE IN BOSTON.

As to the validity of the statutes of the state of Missouri and of the charter of Kansas City, of which Mr. Tichenor writes, one can give an opinion only after a careful examination of their provisions relating to this matter. The dictate of good judgment is to have the provisions of the charter so framed that there can arise no question of the validity of the special ordinances passed in pursuance thereof.

souri (Fay *v.* The City of Springfield, 94 Fed. R. 409). In that case Judge Philips, relying upon Norwood *v.* Baker, clearly holds that, as the only theory of the law under which the cost of such street improvements can be imposed as a special tax upon the abutting property rather than as a burden upon the entire municipality is the fact that the local property is peculiarly benefited thereby, statutes or ordi-

UNLOADING GARBAGE—THE NEW METHOD IN BOSTON.

nances which assume arbitrarily that such local property is benefited in proportion to the frontage thereof are invalid unless the opportunity is afforded at some stage of the proceedings for the owner of the property so assessed to be heard upon the question of fact as to whether or not the benefit is equal to the burden imposed.

In conclusion, we may safely assert that the construction herein placed on the case of Norwood *v.* Baker will be followed by our courts as the question presents itself to them from time to time. The case will have great influence, not so much from the application of the narrow precedent therein established as from the indication it gives of the principles which the court will follow when similar cases come before it for adjudication. As Judge Philips tersely states the underlying principle: "Equality is equity. And the right of the owner of a lot to have this burden of special tax ratably distributed among the lots benefited does not depend upon the state constitution exacting equal taxation, but has its foundation in 'those elementary principles of equity and justice which lie at the root of the social compact,' and he can therefore invoke for its security and protection the federal constitution, which inhibits not only the taking of private property for public use without just compensation, but the deprivation thereof without due process of law, and denies the state the power to deny within its jurisdiction the equal protection of the laws."

ELECTRIC CONDUIT ROADS.

By Alton D. Adams, M. A. I. E. E.

The unqualified success and great extension of electric street railways has been made possible by the overhead trolley. The trolley system alone has proven independent of practically all conditions of weather and climate, so far as delivery of energy to the cars and the maintenance of a working decree of insulation is concerned. So far as can now be seen, the overhead trolley wire is likely to hold its present position in the great bulk of electric street railway work, as long as the cars are operated by transmitted power. The great advantage of overhead contact in electric car systems lies in the moderate cost and ability to operate under adverse conditions. There is, however, in many cities, a reasonable demand for a system that will deliver the necessary electric energy to cars from underneath, in crowded business streets, and this demand must eventually be met. Since the inception of the electric street railway repeated attempts have been made to operate with the supply conductors underneath or at the surface of the street, and most of these have failed for want of suitable construction, and been replaced by the overhead construction.

A fatal weakness in most surface and sub-surface contract systems for electric cars, thus far installed, has been a lack of effective insulation for the current carrying parts. In practice it has proven very difficult to prevent electrical contacts between conductors at or near the surface and the earth. These contacts result mostly from the accumulation of mud and water in the

conduits or on the surface in such a way as to allow the passage of current from the conductors to the ground. Earth connections are also found by failures of insulating supports at one or more points and by the occasional arcing at broken contacts. These earth connections may consume a very large amount of power in extensive system and frequently melt and destroy parts of the particular conductors where they occur.

The means by which electric energy is delivered to the car, point underneath, are known as the open conduit and the surface contact systems. In the open conduit system a continuous passage is provided between the rails with its top just below the surface of the ground, and with a narrow slat or central opening along its entire length. Within the conduit are erected two conductors on insulating supports, all so arranged that a proper shoe, extending downward through the slot, from the car, may make contiguous contact with the conductors as the car moves along. To give proper distance between the electric conductors and the sides and bottom of the conduit, it must be quite large, and to prevent filling with mud and water should have frequent sewer connections. This open conduit is very simple, but with the electric pressure at which street railways are commonly operated the tendencies to break down the insulation, to maintain arcs when once started, and to a large power leakage are very serious matters, unless the size and structure of the conduit are such as to involve a very large first cost.

As the expense of the open conduit system, under usual conditions as to operative pressure, excludes it from all except the most used streets, in the largest cities, practice must be materially modified before its application is at all common. The surface-contact system has been proposed as a substitute for the open conduit, without the disadvantage of the latter's great first cost. The surface contact system provides a succession of conductors, exposed at as near the surface of the street, and at such a distance apart that a contact shoe attached to the car reaches one surface conductor before it leaves the preceding one. As it is impractical to maintain a series of conductors constantly of about five hundred volts pressure on the surface of the street, the system includes means by which the series of contacts along a line of track are put in contact with an underground electric conductor at just the time when the car reaches them and disconnected as soon as it has passed over. To automatically make and break connection between the surface contacts and the underground cable, an electromagnet is necessary for each contact element, the winging of each electromagnet being put in action by the moving car. The length of a street car is, at most, but a few feet, and there must be a separate contact and magnet for each car length of track in city streets. Actuated by each magnet is a switch that closes or opens according to the position of a car near its contact element. Mud and water in the streets make it impossible to maintain any considerable degree of insulation between these surface contacts and the ground, so that a large amount of leakage must occur while they are connected with the underground conductor. It is thus evident that the essential elements in a surface contact system are numerous and complicated.

The most practical location for

the numerous magnets and switches is in water-tight boxes along the line of track beneath the street surface. If one of the magnets fails to act from any cause the contact section which it controls remains either without energy or constantly in contact with the underground cable. In the former case cars may not be able to get past the faulty section; in the latter a point of leakage and serious danger to street travel is set up. As the length of track along which the surface contact elements are charged with electric energy must equal at any one time, the combined length of all cars in operation, several miles of these contacts may form a low resistance ground connection on a large system with muddy streets. No little effort and capital have been expended on surface contact systems to date, with but slight practical success.

For exhibition purposes the automatic surface contact system is ideal. A working model in a dry place, with well insulated contact parts and magnets, well oiled switch hinges and plenty of skilled attention works to the satisfaction of promoters and investors alike. When it comes, however, to the hard conditions of commercial service, in wet and muddy streets, over tens and even hundreds of miles of track, the automatic surface contact system never has had, and in the opinion of many never will have, any extended success.

With either a conduit or surface contact system it is possible to use the rails as one side of the electric circuit, but the difficulty of insulation on the other side is more serious when this is done, and with the common pressure of 500 to 600 volts it has been found desirable to insulate both sides of the circuit and omit the use of rails as conductors.

The third-rail method of supply to electric cars has shown favorable results on elevated roads and others that own their right of way, the third rail or conductor being erected on slightly raised insulating supports between or at one side of the other two. With the third rail as one side of the circuit, the regular track is usually employed for the other conductor. It is obvious that for regular street car work the third-rail system is not available, since a raised conductor carrying electric energy at comparatively high pressure is out of the question for street use. The present development, therefore, includes two systems of energy supply to street railway cars, the overhead trolley wire, cheaply erected and practical in nearly all locations, and the open conduit, very expensive to construct and suited only to use in a few important city streets.

Since the main objection to the open conduit—that is, a conduit with a narrow slat at the top which permits the contact shoe of the car to enter—is its great first cost, it is interesting to inquire into the elements that make this cost necessary and to consider whether any of them may be removed. In order that two electric conductors, carrying electric energy at comparatively high pressure, may be erected in a conduit at a suitable distance apart and also from its sides and bottom, the conduit must be large. To allow for the discharge of water and mud that finds its way into the conduit through the slat at the top, the dimension of depth must be considerable. Requirements as to the size of the conduit are increased by the usual construction, which allows no entry to it from

the top, except through the narrow slat, which is hardly more than three-fourths of an inch wide. With the construction of conduit indicated, it becomes to some extent a sewer for surface water and street mud, and should have a connection with the regular street sewer at every block.

The regular street railway pressure of 500 to 600 volts has a very important influence to determine the size and expense of conduits. These pressures are dangerous to life as well as property and great care must be used to prevent the possible contact of animals, vehicles or persons in the street with the conduit conductors. If the pressure at which electric energy is delivered to street cars can be materially decreased, the difficulties and cost of conduit construction in city streets will not present so serious a problem. The capacity to maintain an arc and the tendency to break down insulating supports vary very rapidly with the pressure, as does also the power leakage through a system of low insulation, such as is quite certain to exist in street railway conduits.

If the operative pressure at the cars can be sufficiently reduced, it seems probable that some combination of features in the open conduit and the third rail system will prove available in city streets at a much less cost than is now necessary for open conduit, operated at the usual street railway pressure. A glance at past and present street railway practice will give an idea as to the way in which any desired pressure may be obtained. During some years the general and standard pressure for electric street railway work has been from 500 to 600 volts, according to the loss of pressure to be provided for in the lines.

In the past, and in most cases at the present time, the pressure generated at the power station is that delivered to the car motors plus the line loss, no intermediate devices being commonly used to materially raise or lower the station pressure. It is true that on very long lines where the volts lost in the feeders are such as to seriously reduce the station pressure, boosters or batteries are not infrequently employed to compensate for the line loss and give the car motors their full rated pressure. This practice, however, does not amount to a transformation of the station energy to that of another form at the motors. About 500 volts seems to have been selected as standard for street railway work, because it is not too high to be readily handled at controllers and motors, and at the same time is high enough to keep the cost of copper at a moderate figure for distribution over considerable areas.

The constant extension of electric street railway systems over great urban and interurban areas has brought with it a still greater proportionate increase of investments in copper conductors. This condition arises from the well-known law that the weight of copper to distribute electrical energy at a constant per cent. of loss varies as the square of the distance to which it is transmitted from the generating station. As it has not been thought desirable to increase the operative pressure at car motors, because of the troubles likely to there develop, a result of extending electric railway systems has been to multiply the number of generating stations, some large cities now having several generating stations, in different parts, for their street railway lines. This increase in the number of electric traction stations for comparatively limited areas does not tend to economy of

operation in the matter of either coal consumption or labor, and there is a marked movement away from designs that include scattered generating units at this time.

The direct current has long held, and seems likely to continue to hold, the exclusive control of electric railway work, so far as the car motors are concerned, because of the more satisfactory adaptation of direct current motors to the purpose. The necessity for high pressure distribution to effect economy of conductors, the superior ease with which electric energy at high pressure may be generated in large alternating current units, and the more ready transformation of alternating currents to any desired pressure at the point of use, combine to give this form of current a preference over the direct for the operations of generation and transmission to the vicinity of its use. The high-pressure alternating current supply is reduced to low-pressure, direct current at substations, along the electric car lines, by means of transformers and rotary converters, and economy of conductors is effected while the car motors receive direct current of the usual pressure. One illustration of this system is found in the great traction station now under construction in New York city, which, when completed, will be the largest power-generating plant in the world. The system of alternating current transmission and conversion to direct current near the points of use for car lines makes it practical to deliver current to these lines at any desired pressure. It seems probable, therefore, that the prospects of conduit construction in many places may be materially advanced by this important change in street railway practice.

A SIMPLE OUTFIT FOR REPAIRING ASPHALT PAVEMENTS.

By Daniel B. Luten.

I note in your issue for January, 1900, with regard to sheet asphalt for small cities: "One note of warning must be sounded, especially for cities so small that only two or three asphalt pavements are probable. Repairs will be expensive after the guaranty period has expired, for experts must be imported, with tools, kettles and materials. Repairs will probably be delayed, therefore, until a large number are necessary, the more rapid deterioration of the pavement where a hole develops being offset by the cost of getting in a repair outfit for small repairs at the proper time. The next plea for inventions in the asphalt field, is an inexpensive yet efficient repair outfit."

The accompanying photograph shows a repair outfit used in Lafayette, Ind., by one of the oldest sheet asphalt companies in the United States, for making repairs to the sheet asphalt pavements laid by them in September, 1899. The photograph was taken while repairs were being made in November, 1899.

It consists of a one-horse dray carrying a small hand-blast forge; over the fire, supported by half a dozen bricks, was a section of boiler iron, and on this the asphalt paving mixture was heated, stirred in

ASPHALT REPAIR OUTFIT IN USE IN LAFAYETTE, IND.

the meanwhile by a shovel in the hands of the expert. The material for repairs had been mixed at the plant and allowed to solidify in barrels. A half-barrel of the mixture is shown on the front of the wagon. Fragments of this ready mixed material were heated on the forge, then tamped into the hole from which the defective material had been cut away, and finally smoothed down with irons heated at the forge.

Two men were required to operate the outfit, one of whom was the driver of the dray. The other doubtless was an expert on asphalt pavements. The method certainly looks inexpensive; its efficiency has not been tested in Lafayette, but after two months the patches, thus applied, appear to be wearing as well as the rest of the pavement.

THE QUESTION DEPARTMENT.

[By Alton D. Adams, M. A. I. E. E., for MUNICIPAL ENGINEERING.]

SPARKING AT DYNAMO COMMUTATORS.

What amount of sparking at the commutators and the brushes of either arc or incandescent dynamos, can be permitted without serious injury?

L. H. Wannamaker, Supt. L. & W., Orangeburg, S. C.

There is an essential difference, as to sparking between incandescent or constant pressure and some arc or constant current dynamos. What are known as open coil arc dynamos, represented in the United States by the Brush and Thomson-Houston makes, can not be properly operated without sparks at the ends of the brushes, and these sparks should each be about 3-16 of an inch in length. If the adjustment of the brushes on these machines is so made that there is no spark, there will be frequent and excessive flashing that will render them entirely inopera-

tive. Another class of arc dynamos, called the closed coil type, of which the Wood machine is an example, can be operated with little or no spark. The current, usually from 6.5 to 10 amperes delivered by an arc dynamo, is so small that but little wear of the commutator and brushes is caused by the ordinary amount of sparking. In constant pressure dynamos, which are commonly used for incandescent lighting and to supply electric motors, the current, in amperes, depending on the capacity and voltage of the machine, is often large and any considerable sparking works a rapid destruction of the commutator and brushes. Unless sparking is very heavy its ill effects are usually confined to the commutator and brushes, and do not work internal injury.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

MUNICIPAL HEATING BY STEAM OR HOT WATER IN CONNECTION WITH ELECTRIC LIGHTING.

We would like to have some information on municipal heating by steam. The circumstances are about as follows: Our electric light plant is about one-half mile from the center of town. Would it be possible for us to convey the exhaust steam from our plant to the center of town by pipes and use it for heating purposes, for dwellings, etc.? What sized pipe and what additional appliances would we need to accomplish the desired result? Approximately, what would a steam-heating plant cost for a town of 5,000 population, and what is the general manner of construction? Could steam be used successfully at a point from one-half to three-fourths mile away from the plant, and from 20 to 50 feet higher?

Yours very truly,
Westmoreland Electric Company,
Per W. R. Kenney, Supt., Greensburg, Pa.

It is certainly impossible to heat the town by *steam* under the above conditions with any economy. The exhaust steam is successfully used to heat water which, in turn, is pumped through protected pipes which are tapped for house service, as in the case of gas and water, except that there must be a return pipe and return connection to this pipe from the cool end of each house service. In one such case water leaves the station at a temperature of 185° and returns through a mile and a half of pipe and the house services, arriving at the station with a temperature of 80°. Six-inch pipe is used in this case and is designed to be large enough to serve three miles of line. A few special forms of connection are needed, and the pipe must be so protected that the loss of heat into the ground may be a minimum. Otherwise the system is not more expensive than a system of ordinary water pipe. A paper by Arthur C. Loomis, city engineer of Mattoon, Ill., describing the plant in that city, may be found in the proceedings of the Illinois Society of Civil Engineers and Surveyors for 1899; J. A. Harman, Peoria, secretary. Similar plants, some of them more or less experimental in their nature, have been installed by H. T. Yaryan and others in Toledo, O., La Porte, Ind., and Missouri Valley, Iowa. Isaac D. Smead & Co., of Toledo, O., can give full information and details of plants of this nature. Mr. Smead suggests that unless the plant runs day and night, does not use condensing engines and will stand a back pressure of two to seven pounds, the hot-water plant will not be successful.

The amount of back pressure depends upon the proportion of water to be heated to the amount of exhaust steam and the consequent temperature required for that steam. For a small system the back-pressure would be slight. Mr. Smead would limit the distance to pump

the hot water to reach the distribution to a half-mile, and would estimate the cost of a successful system of the size desired at about $15,000. There may be considerable variation from this figure on account of length of streets for scattered houses or compactness of the town. Mr. Yaryan claims some patents on combination of electric light and hot-water heating plant, and possibly on some details, with the nature of which we are not acquainted, and Mr. Smead controls some patents. Sizes of pipe and size of connections must be worked out in detail for the individual circumstances, number of circuits, length of each, number of services and location, temperature of water to be carried, consequent quantity to be supplied, etc.

FORMULA FOR STREET GRADES.

In this department last month, under the above heading, the derived formula, as printed, is not exactly right, as may be seen by performing the operations of reduction. It should read:

$$X = \frac{L\,S - A \times B.}{2\,S.}$$

STANDARD NUMBER OF GALLONS TO A CUBIC FOOT OF WATER.

Is the standard number of gallons in a cubic foot 7½ or 7.480?

Benj. L. Williams, Jr.,
West Orange, N. J.

There are 231 cubic inches in a U. S. liquid gallon and 1728 cubic inches in a foot. It is evident, therefore, that there are 7.48052 U. S. liquid gallons in a cubic foot. The error in assuming 7½ gallons in a cubic foot amounts to 0.26 of 1 per cent., or one part in 385 only. For all calculations, except those requiring the utmost accuracy, 7½ gallons can therefore be assumed as equivalent to a cubic foot, and computations can be greatly simplified. If we ever gain sense enough to use the metric system this sort of computation can be reduced to locating a decimal point with vast saving of time, temper and liability to error.

HOW TO KEEP TREE ROOTS OUT OF SEWER PIPE.

We are having trouble with 6-inch terra cotta sewer pipe, laid and put into use about eight years ago, from the fibrous roots of sidewalk trees getting into the pipes through the joints, and choking them up. The trees which appear to be giving almost all (if not all) the trouble, are N. C. poplars, which send out roots to immense distances in search of moisture. Our soil is dry and gravelly, and in some cases these trees, which were planted at the same time the sewers were laid, have reached pipes as much as 25 and 30 feet distant. We are apprehensive that the trouble, which, up to now, has only been occasional, will be getting worse, and write to ask if you know anything which would kill these roots. The trouble comes, doubtless, from imperfect joints, and if we can find no remedy, we shall probably have to take up and re-lay a good deal of sewer pipe, at quite a large expense.

Subscriber,
Roland Park, Baltimore, Md.

The only way to keep tree roots out of sewer pipe is to have absolutely tight joints. If there is much trouble, pipe with extra long bells should be used, or each joint should be completely enclosed in a well placed jacket of Portland cement mortar. The roots can not be killed except by killing the tree. The roots can be cleaned out by means of a special tool with knives or scrapers, and without much trouble if the tool is run through the sewer at frequent intervals before the roots have grown enough to cause any stoppage. A wire or chain can be run through from manhole to manhole and the tool drawn through by means of it. The wire can be left lying in the sewer until next time to use it, thus insuring a way to pull the tool through if any stoppage should occur, and saving time in getting a

float through. A few minutes spent once in two or three months or at periods the length of which is determined by experience, will keep the sewer open at small cost. The cost of cleaning out a single stoppage will pay for many such operations and it is possible that the interest on the cost of relaying the sewer would pay the expense. Put in more manholes if they are too far apart for convenient working. At any rate put one in at each change of direction or of gradient.

PAYMENT FOR SERVICES AND EXPENSES OF SURVEYORS.

I take the liberty of presenting to you a question relative to the compensation of county surveyors in the state of Iowa. Section 543 of the code of Iowa reads as follows: "Surveyors fees. The county surveyor is entitled to charge and receive the following fees: (1) For each days service actually performed in traveling to and from the place where any survey is to be made, and for making the same, and return thereof, four dollars. (2) For making up the record of any survey, and the plat and field notes thereof, one dollar per page. (3) For certified copy of the plat or field notes, fifty cents."

During the last four years, while I was holding the office of county surveyor in Clinton county, I always charged my clients with my actual expense for railroad fare and transportation in traveling to and from the place, where the survey had to be made, in addition to my fees of $4 per day.

This month, when I presented a bill to our newly elected county supervisors for work done by order of the county board, they objected to the payment thereof on account of such additional charges, claiming that I was not entitled thereto, and that I must pay railroad fare and other cost for transportation out of my fees of $4 per day.

After discussing the matter for some length of time the board allowed my bill in full, but there remained some dissatisfaction in regard to the legality of the said additional part of my claim, and we will probably be confronted with the same question hereafter.

Now it is a fact that if the law should not allow me to recover from my clients my actual expense in railroad fare and transportation, which sometimes exceeds $4 per day, I will have to pay in some cases from $1 to $2 per day, in addition to the compensation received, for the honor of being county surveyor of Clinton county. Please give me your opinion on this subject. Respectfully,

A. Schnell.
Clinton, Iowa.

This is perhaps a question of law, and if the law is simply crystalized common sense, as has been said, this is a place to apply it. It would seem from the wording of the law that the four dollars is paid for the *service* actually performed in traveling to and from the locality of the survey and in making such survey, and that *expenses* incurred in traveling and making the survey could not be considered as services. It is hard to see how they could be considered as equivalent terms, or how legitimate charges for expenses could be objected to, notwithstanding they are not mentioned in the law. Custom governs where the law is silent, and, from messenger service up, the expenses of the servant are additional to the charge for services, unless specific contract is made or the servant neglects his rights. Surely where the expense bears an appreciable ratio to the charge for services, common sense as well as custom and the dictionary (which is crystalized custom) would make expenses additional to charge for services.

COST OF LAYING VITRIFIED PIPE SEWERS AT VARIOUS DEPTHS.

I wish to know the estimated cost of laying vitrified pipe sewers at various average depths, sizes from 8 inches to 24 inches, our soil being ordinary red clay. I inclose a table for the purpose, which is an extension of one found in Blackmer & Post Pipe Co.'s pamphlet, "Vitrified Pipe v. Brick Sewers." I wish to find the cost of trenching per running foot for the sizes given in the table and at the various depths, and also the cost of laying and cementing, including the backfilling, all complete, of the different sizes and depth as indicated in the table.

L. C. Hjorth,
City Engineer, Neenah, Wis.

The following table is prepared on the following basis: Labor, $1.50 a day; width of trench, 18 inches

more than diameter of pipe; average day's work of man, 11 cubic yards; no machinery, no sheeting, no water:

COST OF DITCHING, REFILLING AND TAMPING.

Size of Pipe.	Width of trench required.	Depth of trench, 6 feet.	Depth of trench, 8 feet.	Depth of trench, 10 feet.	Depth of trench, 12 feet.	Depth of trench, 14 feet.	Depth of trench, 16 feet.	Cost of laying pipe, including bedding, handling, cement and jute & jute'g.
8 inch	26	$0.16	$0.22	$0.38	$0.44	$0.55	$0.66	0.05
9 "	27	0.17	0.23	0.34	0.46	0.57	0.69	0.06
10 "	28	0.18	0.23	0.35	0.47	0.59	0.71	0.06
12 "	30	0.19	0.25	0.37	0.50	0.62	0.75	0.06
15 "	33	0.21	0.28	0.42	0.56	0.67	0.84	0.06
18 "	36	0.22	0.30	0.45	0.60	0.75	0.90	0.07
20 "	38	0.24	0.32	0.48	0.64	0.79	0.96	0.07
24 "	42	0.26	0.35	0.53	0.70	0.88	1.05	0.08

Folwell's "Sewerage" gives the minimum cost for similar conditions about one-half the above figures, without stating the basis of table. If labor costs less and does more work, both of which are possible in many localities, and profits and superintendence are not allowed for, the discrepancy disappears. He also makes the cost of laying pipe less for the smaller sizes. If sheeting is necessary the cost will be increased 25 to 100 per cent., according to amount of sheeting necessary to hold the soil.

HYDRAULIC METHODS OF DREDGING AND FILLING.

Will you kindly inform me if there is an apparatus or outfit, either under patent or otherwise, for sucking or lifting sand from river bottoms? *James E. Troll,*
226 Equitable Building, Baltimore.

Patents for a hydraulic method of dredging and filling are held by A. B. Bowers, of San Francisco, Cal. A number of corporations in various parts of the country are licensed to use the system, including the American Dredging Co., 236 Walnut St., Philadelphia, Pa., and the Bowers Hydraulic Dredging Co., 211½ Market St., Camden, N. J. A vacuum process is operated by the Dredging and Filling Co., 15 Cortlandt St., New York.

COMMENT ON CURRENT TOPICS.

Duty of Local Engineering Societies. Mr. L. E. McGann, the Commissioner of Public Works in Chicago, delivered an address at the annual banquet of the Western Society of Engineers, in which he deplored the existing unscientific methods of planning public works by council committees and politicians, instead of by expert engineers and public spirited citizens. Among other things he said:

"The engineering work to be done in this city, should be done with reference to a completed city in every detail. Its roads, its walks, its bridges, its water service, its sewer service, all are in such condition as to require the best thoughts of the best minds in this city, and I know of no body of men better equipped to undertake that duty for Chicago than the Western Society of Engineers. The duties devolving on you as citizens require that you should step outside of the usual lines of employment, and at least give to this city, which has provided opportunity for so many engineers, the benefit of your best thoughts in formulating plans, in the execution of which many engineers will certainly receive benefit."

It would be difficult to believe that this was meant seriously if it were not so common an opinion among the best citizens. It has

often been true that large projects for improvements have been developed by men who were not technical engineers, and who were conscious enough of their own deficiencies to depend upon engineers to work out the details and to correct the general lines of the plan to correspond with engineering possibilities and the existing conditions. It has much more often been true that ordinary problems of public improvement have been developed by men with similar lack of technical knowledge and training who were so taken with their acuteness in happening upon the subject in a popular way that they assumed a knowledge they did not have in a field in which it is absolutely necessary to success. Such men are responsible for the deplorable waste of money and bad condition of public improvements in most of our cities. There have been enough of the successes by the former class to mislead the unthinking into accepting the projects of the second class until it is too late to withdraw. The engineer occupies a very subordinate place, evidently, and for two or three reasons. His training has not been broad enough to enable him to take a comprehensive view of the whole problem. His practice keeps him so close to details that it narrows his vision rather than broadens it. His consequent distrust of his conclusions, drawn from what he considers insufficient data, restrains him from open discussion and assertion of the dignity and duties of his profession. He will let the glib-tongued contractor or politician talk, with a basis of fact and reason far less than his own without any effort to prick the bubble.

If Mr. McGann may be assumed to mean that engineers should take the place which belongs to them and should lead public opinion in the direction it should go in regard to public improvements, which directing they are better equipped for than any other body of men, with one excepted noted, he is exhorting them to take up a line of action which they have too long neglected, one which will at the same time pull the cities of the country and a large body of the engineering profession itself out of the slough in which it is now floundering. If we are to take the letter of the speech and believe he means that the Western Society or any other body of engineers should develop engineering features on professional lines for the benefit of the city, we must protest, because the society would be undertaking a thankless job which would take the bread from some fellow-craftsman, and would be still more unprofessional in presenting without invitation plans which in the nature of such a body could not be well digested and prepared. The society, with but little better preparation for the actual demands of the problem, would be doing for the details of the problem just what we are protesting the second-class of talkers referred to above should not do.

Mr. McGann seems to relegate

the engineers to the subordinate positions in the development of the comprehensive schemes for municipal improvement, and then to ask them to do this subordinate work without money and without price, that a few inspectors and surveyors and a very few engineers may have some work on the construction. He is not to be blamed for taking this view; it is the common one. The engineer is responsible for the light, or rather the darkness, in which he stands. Let him study his problems in the large way, and let him enter into their public discussion with the power due to his honest conviction, and he will take the lead in developing projects, and control them, as well as perform the less important, though no less necessary, duties of working out the detailed plans and supervising their construction. In other words, he will become the professional man, where he is now too largely the craftsman.

More Filtration Experiments.

Mr. Edmund B. Weston has put in the form of a paper for the American Society of Civil Engineers, the results of his experiments upon a mechanical filter, constructed by the New York Filter Manufacturing Company, and belonging to the East Providence (R. I.) Water Company. The tests were made during the regular action of the filter under the every-day conditions of the water plant during the months of March, April, May and June, 1899. They are of special interest on account of the statement that the filter was not run to secure the best possible results, but was run, as it might be expected to run under the same conditions in every-day use. The report of the tests indicates that the tests were not so carefully made as those reported by Mr. Fuller at Cincinnati and Louisville, nor were they so complete. They are therefore not so satisfactory, nor are they conclusive, but they are of interest since they corroborate those results completely and indicate that the mechanical filters will give as satisfactory results in regular use as they do under the carefully observed and regulated conditions of the original investigations. The water in use is very different from that of the Ohio river, and the rate of filtration may usually be greater for equal ratio of purification. The reports regarding cost of operation are not so satisfactory. Under the conditions at the station no additional assistance was needed to attend the single filter in use, though, of course, the work of the pumping station attendants was materially increased. No allowance for labor of taking care of the filter is made in the statement of cost, which makes the filtration very inexpensive, the cost of the alumina, $2.15 per 1,000,000 gallons of water filtered, being practically the only expense. The single filter of 500,000 gallons capacity per twenty-four hours, cost $11,500, and the

capacity of the works can be quadrupled at an additional expense of $9,500.

Mr. Geo. W. Fuller, in discussing this paper, says that some of the methods of test used have been found by him to be less satisfactory than those finally used by him in preparing his reports on Ohio river water, and that the figures given are not comparable with his own. He shows the reasons for this in his comparison of the methods used by the two investigators.

It is also hardly fair to compare the cost of filtration as reported with that in other plants, though it is perfectly fair to give the statements of the additional cost of operation of works due to filtration in the form used, since this is all that is necessary to add to the expense account of the works, and there are many small plants in exactly the same condition, to which the results here given can be applied directly.

Opening of Chicago Drainage Canal.

The drainage canal is now officially open and by the time this number reaches our readers the first Lake Michigan water will probably have reached St. Louis. At this writing the discoloration in the Illinois river due to the first emptying of the river into the canal is noticeable with the rise of water. This rise is, however, partially concealed by a rise due to several days rainfall, a fortunate circumstance, since this largely increases the dilution of the first flow and thus reduces it to something like the normal low water condition when the canal is flowing at its full capacity. Peoria is keeping close watch of the chemical and bacteriological condition of the water with little expectation of finding more than temporary increase in pollution of the water. In fact the general opinion along the Illinois river seems to be that the lake water will improve the condition of the river. All the engineering constructions are reported to have worked exactly as designed and the opening was a substantial success, and a demonstration of the ability of the designers and constructors.

Artificial Codes of Ethics.

After great exertions the architects and others intererested in improving the character of government buildings and in enhancing their artistic merit succeeded in securing a modification of the laws governing the government architect's office, so that the preparation of plans could be thrown open to competition, and a competent commission could be appointed to select the most meritorious design. Provision is made for paying the fees of the successful architect, and the expenses of making the award, but no direct provision is made for compensating those who present plans which are not chosen. Since the competition on a building is restricted to about ten leading architects who are invited to present plans for that building, some provision for payment of the expense of making the plans

would seem to be eminently proper. In the case of the public building for Baltimore it is proposed, since payment can not be made directly by the treasury, to pay each unsuccessful competitor $500, the amount to be deducted from the commission of the successful architect. Ten architects of the highest standing have been found who will accept these terms and consider them quite proper. Evidently the only effect of these terms is to diminish the commission of the successful architect by $4,500. But since he is to receive 5 per cent. on the cost of the building this is a very small percentage of his entire compensation. This slight scaling down of the commission is not objected to by those who propose to accept the invitation to compete.

It is customary in open competitions to offer one or more prizes for the most meritorious designs, the preparation of plans and the supervision of construction being awarded to the best, and unsuccessful competitors receive no compensation. Evidently it would be impracticable to offer compensation to all who might present plans. In the present case, however, the competition is definitely limited to invited artists, who thus take on some characteristics of direct employment, and are deserving of whatever compensation may be agreed upon. Since all the compensation paid must come from the fixed percentage set aside by law, an agreement among those interested, on such distribution of this sum as is proposed, would seem to be eminently proper, and in agreement with the spirit of the architects' code of ethics and in practical agreement with the official standard of fees. There is difficulty, however, in finding a board of judges to make the awards, all those invited having declined to serve, claiming that this agreement to reduce the fees of the successful architect is unprofessional, and that the unsuccessful architects should be satisfied with no compensation.

There is evident difference of opinion among eminent architects as to what is professional conduct. Those who consider the proposed procedure unprofessional are evidently holding to the strict letter of the code without reference to the fact that there is no variation from it in principle and only an almost infinitesimal departure from the schedule of fees. The proposed modification of the terms of the competition to award all the commission to the successful competitor is far less equitable than the present proposition and from this point of view is less satisfactory from an ethical standpoint. Any other program will require an act of congress and great trouble and delay. These considerations have no effect, however in the face of the letter of the architect's schedule of fees. How many of them adhere to the schedule within the small per cent. in question?

It is such controversies as this which make engineers satisfied with

their lot in being without standards of procedure and schedules of fees, and blind to the greater losses of prestige and of pocket to which they are subject.

Safety from Electric Railway Currents.

The danger to public interests from some kinds of negligence, is so great that redress in civil courts, or wrongs resulting from it, can not safely be trusted to check the evil. That construction and condition of electric railway tracks and their return wires, which results in the destruction of gas and water pipes, together with other underground structures, by stray currents from the electric system, is evidently one of the examples of willful negligence that require legislative enactment for its suppression. The electric railway industry, in spite of its vast proportions, is of recent origin, having attained practical importance within the last 15 years. On the other hand, the destructive action of electrolysis is comparatively slow, and gives little or no warning until its work is complete. It therefore happens that, while new examples of electrolitic action on gas and water pipes are rapidly coming up, the destructive process has not been completed as yet in many places, and the danger is not fully realized. Even in those cases where damage to pipes has become the basis of a suit for recovery, the loss to society at large by the destruction of a part of its equipment, can not be made good whether the loss remains on the water or gas works, or is shifted to the electric company.

The conditions of electric railway construction necessary to avoid electrolytic action are known to engineers and should be embodied in statutes, just as are certain matters concerning steam boilers, that relate to the public safety. Inspectors should be appointed, under proper laws, to see that all new electric roads adopt only constructions that conform to the law; and existing roads should be brought up to the required standard as rapidly as practical. It may be said in brief that the first cost of construction is all that stands in the way of relief from the destructive action of street railway currents. Unless proper laws are enacted it seems quite certain that many street railway companies will continue to prefer a possible suit for damages to a certain large increase in the cost of construction.

So long as electric currents are distributed from a generating station to street cars over a large area there are three main ways in which electrolysis may be prevented. Couduits may be provided beneath the tracks and conductors erected in these conduits, which will convey the necessary electric current to and from the cars as has been done in a few cities where the heavy traffic made the great cost of this system practical.

Again, two trolley wires instead of one may be erected over each track and the current delivered to the cars from one trolley and re-

turned to the overhead feeders by the other trolley, as is done in the city of Cincinnati. This double trolley construction costs more than the single-trolley line, and is harder to properly operate, but is recommended by some engineers. There is no doubt whatever that either the double conductor conduit system or that with the double overhead trolley wires, will be free from trouble with electrolysis, since in neither does current enter the rails or the ground.

The third method by which damage from ground currents may be avoided is that pointed out elsewhere in this issue, which by insulated return wires, either overhead or in conduits, keeps the entire track at a nearly constant electric pressure so that there is no tendency for current to flow between distant points along the track or through the earth. As this last method is cheaper than either of the others, and is easily applied to all single-trolley roads, using a rail or ground return, its adoption should be enforced by proper legislation in places where the double conduit or trolley system are not adopted. The property saved by prompt action in this matter will outvalue many thousand times the cost of necessary construction.

WATER WASTE.*

By Joseph Beardsley, C. E.

Water waste, while it is one of the most annoying difficulties with which the water-works engineer comes in contact, can scarcely be considered an engineering problem, for the reason that the solution of it is perfectly obvious and the means of preventing it easily available, providing only that the administrative officers are sufficiently broad-minded and intelligent to appreciate the situation. It is essentially an administrative rather than an engineering question, and the only reason for presenting such a subject to the attention of engineers is that it usually falls to engineers to educate the administrative officers up to the point of applying the one infallible remedy and the water takers to accepting it as the only just means of estimating their water rates.

Cleveland was fortunate in this respect, and meters have been in service here for considerably over twenty years without serious objection from either administrative officers or water takers.

According to American ideas, air and water are on about the same plane—the supply of each should be equally free and limited only by the demand, no matter of what nature—and this idea was perfectly proper fifty years ago, when every man had his own well or running stream from which to draw his supply, which was usually limited only by his physical ability in drawing it. Even then, however, no man drew water from his well for the pleasure to be derived from spilling it on the ground.

Now, with the development of the modern city, we have all this

*Read before the Civil Engineers' Club of Cleveland, from the Journal of the Association of Engineering Societies.

"drawing of water" accomplished for us, and instead of expending physical effort we pay for it in cash.

We are able to have a supply at any point we desire it, and it comes with the simple turning of a cock; but with all this ease of accomplishment comes the idea that it is not incumbent on us to use any discretion in the consumption of what comes to us so easily.

This idea is fostered, too, by the manner in which payment is made, in the great majority of cases, for this service. When one has to pay only a certain fixed rate, based on the number of rooms or fixtures, it is easy to fall into the habit of thinking that it really makes but little difference how much water is consumed and to procrastinate going for the plumber if any of the fixtures get out of order and run continuously.

If any qualms of conscience do make themselves felt, we reason that our neighbor is probably doing the same thing anyway, and ask ourselves why shouldn't we? or, again, somewhat contradictorily, we feel that "just our one faucet running doesn't waste much water." We should stop the leak very quickly, however, if the supply depended on our own physical exertions, or if we had to pay for it according to the amount we consumed.

The operating expenses of the Cleveland water-works for the year 1897 were $182,694.22.

The total cost of the plant, including that year, was about $8,500,000, the interest on which, at 5 per cent., which would be a fair average for the period covered, would be $425,000, making a total of $607,694.22. The total water pumped during 1897 was 17,658,470,308 gallons.

This makes the cost of furnishing water about 3.4 cents per 1,000 gallons, and in these figures no allowance is made for the cost of pipe extension, river tunnels and other minor construction which is paid for out of the income without the issue of bonds.

This shows that while water is a cheap commodity, it still does cost something, and it is perfectly apparent, since the expenses are nearly proportional to the amount of water pumped, that water rates can be reduced only by reducing the amount of water pumped, or by cutting off all the improvements that are paid for out of the revenue.

In Cleveland the minimum water rate with a private meter (one set at the expense of the consumer) allows a consumption of 150,000 gallons at a cost of $8 per year.

These meters are set almost invariably on dwellings, and form a fair basis of estimate of the necessities of a family. At this rate each service would consume 410 gallons per day, and, estimating six consumers to a service, would allow a per capita consumption of 68 gallons per day. This would seem to be a liberal allowance, and experience has shown that the consumption on private meters seldom reaches this rate. In the few cases where it is exceeded it is almost invariably found that there has been a leak or some unusual condition of consumption. Dwellings where private meters are in service would pay by assessment from $12 to $20 or more, and under present conditions this rate can not be reduced without creating a deficit in the revenues of the department.

An expert commission appointed in the city of London to investigate the subject of water supply, estimated that 42 gallons per capita per day was a liberal supply,

and in Paris the actual consumption is 36 gallons. In Cleveland the consumption in 1897 was 136.3 gallons per capita per day, which was the highest in the history of the city except for 1895, when it was 136.6 gallons; 24.4 per cent. of the total pumpage for 1897 was metered, and this may fairly be taken to represent the amount of water consumed for manufacturing and other similar purposes. Deducting this from the average for 1897 leaves 103 gallons on the unmetered services. Assuming our minimum private meter rate as a fair estimate of a liberal supply (68 gallons), this would leave 35 gallons, or 34 per cent. of all water not metered; and, of course, the showing would be much worse if we were to take the London or Paris figures, or even those of the actual consumption on our private meters. This can not all be assumed to be waste, for we furnish a large amount of free water for municipal and charitable institutions, to say nothing of flushing paved streets and sewers and puddling trenches; but a large proportion of it is undoubtedly waste.

In many other cities the showing is much worse, notably in Philadelphia, where our friend Mr. Trautwine has been making a valiant, but so far, I believe, unsuccessful, fight for the introduction of meters.

In a paper read by him before the Engineers' Club, of Philadelphia, in October, 1898, some startling figures are given. In one district of Philadelphia, containing 142 modern seven-room houses, 539 inhabitants and 782 water appliances, 22 of these appliances were found leaking slightly, and 32 were found running continuously.

The water consumed in this district during twenty-four hours was 119,800 gallons, or 222 gallons per capita per day, of which he estimates that only 16,120 gallons, or 13.4 per cent. was used, the remaining 86.6 per cent. being wasted. The figures for water used look rather small, as they allow only about 30 gallons per capita per day; but in any event it is easy to see that a large proportion of the water furnished to this district was wasted.

In another district a similar examination showed that 63 per cent. of all the water furnished to it was wasted.

The average daily consumption in Philadelphia has risen from 36 gallons per capita in 1860, to 215 gallons in 1897. Practically no meters are in service there.

In Cleveland the average daily consumption has risen from 7.75 gallons per capita in 1857 to 136.3 gallons in 1897, the increase being practically continuous from year to year.

Following is the daily per capita consumption in 1890 of several cities:

Allegheny, 238 gallons, with no meter in service; Buffalo, 186 gallons, with .02 per cent. of taps metered; Richmond, 167 gallons, with 1.4 per cent. of taps metered; Detroit, 161 gallons, with 2.1 per cent. of taps metered. Milwaukee commenced in 1875 with an average consumption of about 3,000,000 gallons per day, reached a maximum of 35,000,000 gallons per day in 1894 and has since declined, the maximum in 1897 being a little over 26,000,000 gallons per day, an average of 88 per capita. This was for the single month of July, and the average for the year is only 79 gallons per capita per day. Meters have been in very general use in Milwaukee since

about 1890, and in 1897 there were 20,000 in use, which I should estimate to include at least 50 per cent. of all taps. It is noticeable in the foregoing instance how the daily average decreases as the number of meters increases.

A still more striking illustration of the effect of the introduction of meters is furnished by the experience of Detroit. From 1870 to 1888 the consumption increased from 64 gallons per capita per day to 204 during the latter year. During 1888 meters were commenced, and it has been since steadily continued, until, in 1898, there were 5,393 in service on 10 per cent. of the taps, and including 20 per cent. of the consumption. Since 1888 the consumption per capita per day has varied between 172 gallons in 1889 and 124.5 gallons in 1897. If the meters had not been set, it is safe to assume that the increase in consumption would have risen at the rate that prevailed at the time of the setting of the meters. If this had been the case, it would have been necessary to make additions to the plant that would have involved an expenditure of $600,000 and an increase in operating expenses of $11,000 per year.

The meters are read and kept in repair without noticeable increase in the operating expenses, and they cost only $151,000.

I might go on indefinitely to cite such examples, but enough has been said, I think, to show that in cities where meters are not generally in use there is a rapidly increasing consumption of water, which is largely pure waste, and which involves large additional expenditures every year for plant and operation, while there is no such increase in cities where meters are in general use.

It may be of advantage now to inquire into the manner in which this waste occurs.

Quoting again from Mr. Trautwine's paper, a faucet leaking one drop per second wastes 5 gallons daily; one dropping constantly, but not running in a continuous stream, 9 gallons; a third, running the smallest possible stream, 14 gallons, and so on up to one running, full opening, 2,357 gallons in twenty-four hours.

To come to more concrete examples, we had occasion some years since to meter a number of church schools where there were flagrant wastes of water. On one of these the assessment was $10 per year. In ten days the meter had registered 14,500 cubic feet, and if this rate had been continued the bill would have been $208.80 for one year. Notices and warnings had been served repeatedly on the school authorities, but it was not until the meter was set that any serious effort was made to put a stop to the waste. During this metering of the church schools, however, some political toes must have got trodden upon, for we got an order that no more meters must be set without the express sanction of the mayor. Fortunately, the worst offenders had been metered by that time.

A more recent case occured last month on Merwin street. A foreman had been sent to set a meter for a new manufacturing concern, and by mistake, there being two connections in front of the place, got the meter on the connection for the place next door.

As it was in a district which it is desired to meter generally, no great harm was done, and the meter was allowed to remain. Next day the foreman went to set the other meter, and incidentally took a read-

ing of the first one, finding a consumption of over 1,000 cubic feet in less than twenty-four hours. The assessment rate on this place was $7 per year. The meter rate, at the rate of consumption for the first day, would have been $146, but an investigation revealed a water-closet that was running constantly, and it was immediatly shut off.

Still another case was found in a peculiar way. A main was being laid in a certain street, and in the course of operations it became necessary to cut through a sewer connection coming from a saloon. A constant stream of water was found running in the sewer, and the saloonkeeper claimed to be totally unable to put a stop to it.

The flow was finally stopped by shutting off the water connection for the place.

This was thought to be a favorable location for a meter, and one was accordingly set.

The reading of the meter three days after it had been set was 3,310 cubic feet, and the meter was going constantly. The assessment rate on this place was $30.50 per year. The meter rate, unless the waste is stopped, will be about $160.

If the annual diagram of daily consumption for a large city is studied in connection with the daily changes of temperature, it will be observed that the pumpage runs up with extreme high temperature and also with extremely low temperatures. During periods of extreme cold the waste is due, of course, to the practice of allowing the water to run to keep it from freezing. With the high temperatures the increase is due to excessive sprinkling, to the very general tendency to allow the water to run until it becomes cool for drinking and to the practice of using the water in lieu of ice for cooling purposes. One summer not long since the owner of several large tenement buildings was notified that the consumption on one of his buildings was running to quite an unusual figure, and he desired us to investigate the cause of it. We did so, and found six out of about thirty tenants using their bathtubs as refrigerators. Perishable provisions were put in closed vessels, and then the water was allowed to run constantly over them to keep them cool. All other fixtures in the building had self-closing cocks, so the bathtubs had perforce to be utilized.

Cleveland is not by any means one of the most generally metered cities in the country, but that meters have been set with a consistent regard for measuring the large consumers is shown by the fact that with only about 4 per cent. of the taps metered 24.4 per cent. of the entire pumpage is measured; and the policy at present is to continue, steadily if not rapidly, to place meters in the older sections of the city, where the plumbing is most apt to be defective and where experience has taught us that there is the greatest unnecessary waste of water.

CURRENT INFORMATION.

Powers Asked for a State Sewerage Commission.

The New Jersey State Sewerage Commission has submitted with its annual report a bill which will be introduced in the legislature, providing for the grading of additional powers to the commission. It provides for the appointment of four commissioners by the Governor, with and by the consent and advice of the Senate. Of the commissioners so appointed one is to serve one year, two two years and two three years. The salary is to be $1,500 a year. The bill provides that the commission, or a majority thereof, may from time to time employ such experts, engineers, officers, agents, employes, workmen and servants as it may deem necessary or proper to enable it to perform its duties and carry out the objects and purposes of this act; that it shall be the duty of the commission to investigate the various methods of sewage disposal, in this country or elsewhere; it shall investigate all complaints of pollution of the waters of this state; any person, corporation or municipality found polluting the waters shall be notified in writing by the commission; that time be fixed by said commission, which shall not be more than five years from date of said notice, for said person, corporation or municipality to cease to pollute said waters and make such disposition of their sewage or other polluting matter as shall be approved by the State Sewerage Commission; it shall be unlawful for any person, corporation or municipality to build any sewer, drain or sewerage system, unless said system shall be first approved by the State Sewerage Commission. A section of the bill which is looked on as important provides for the establishment of sewerage districts to include one or more municipalities, and for the construction of sewers within such districts. The board of five persons which shall control each sewerage district shall be elected at the fall election next following the creation of the district. Each year thereafter one person shall be elected, to hold office for five years.

Effect of Water on Lead Service Pipes.

The report of the state board of health of Massachusetts for 1898 contains a review by H. W. Clark, chemist of the board, of the investigations carried on in 1897 and 1898 to determine the effect of different classes of water upon lead service pipes. The effect of different waters on the zinc and tin coatings of galvanized and tin-lined service pipes, respectively, was also studied. Of 136 cities and towns from which information was obtained, seventy-one used neither lead nor lead-lined service pipes; seven used nothing but lead; two used only lead-lined pipe; one used lead or lead-lined pipe exclusively and fourteen others used either lead or lead-lined pipe for over 50 per cent. of the services; the remaining forty-seven towns used from 1 to 50 per cent. of pipe in which lead was in contact with the water, but generally those towns had few lead services, although probably all of them have lead pipes beyond the services in many of the houses.

During the two years some 800 samples of water from sixty-three towns and cities were examined by the board. Of these plans thirty were selected for detailed study, partly on account "of the large amount of lead pipe in use and partly because of real or supposed lead poisoning in these towns." The greatest amount of lead found in any one sample is given for each of these places, ranging from 8.5460 parts per 100,000 at West Brookfield and 2.0440 at Lowell to 0.0023 at Cohassett. West Brookfield is supplied with water from springs, which flow by gravity through small lead mains to cisterns in the cellars, from which it is pumped. The lead here given was in suspension. The Lowell sample was from 300 feet of lead and lead-lined pipe. These two places showed maxima much above any other cities, and the figure for Lowell is far above the average for the series there, which was 0.1899 for services in ordinary use and 0.1933 for water which had stood in a pipe for a number of hours.

Tables are given in the report showing the maximum, minimum and average amounts of lead, and the relations between lead and color, total solida, free ammonia, oxygen consumed, chlorine, nitrates and hardness, the groupings being arranged from greatest to least in order of the particular thing shown in each table, and by both ground and surface waters. The full list of thirty cities is not carried through these tables, however, only those being included in each case the results for which are most significant. The ground waters of sixteen towns showed an average of from 0.1899 parts of lead per 100,000 for Lowell to 0.0065 for Methuen, when in ordinary use, and from 0.1933 to 0.0142 for samples from the same places, after standing in the pipes and fourteen surface waters showed a range of from 0.0788 for Chicopee (Abbe sys-

tem) to 0.0031 for Ipswich, when in ordinary use, and from 0.3921 to 0.0099 after standing. The report says that the groupings by sanitary analysis do not show very clearly the reasons why some waters attack lead and others do not. They apparently indicate, however, that the surface waters having the greatest amount of solids and chlorine and the greatest degree of hardness take the least lead from the pipes; while, with the ground waters, those with the greatest solids and hardness take generally the least amount of lead.

Experiments were made to study the effect upon lead of water to which known amounts of the substance found in natural waters were added in different proportions. The conclusions drawn from these experiments were as follows:

"A review of results of all the experiments indicates strongly that the two active agents in the waters, causing them to take lead into solution, were oxygen and carbonic acid. The purer the water (for instance, distilled water), the more active these agents were upon lead when in this water. The addition of substances which increased the fixed solids tended to decrease the action of water upon lead very greatly."

To verify these conclusions the work of the determination of the dissolved oxygen and carbonic acid in the water supplies which were being examined for lead was begun, but was still in progress when the report was written. Both the experiments and the observations of natural waters show that highly colored water would attack lead if sufficient time and air were allowed for the change of this carbonaceous coloring matter to carbonic acid in the presence of oxygen The New Bedford supply furnishes an example of this, where lead is shown in samples drawn after standing some hours in lead pipes. The ground water supplies of Lowell, Milford, Kingston and Fairhaven have had or are having many cases of lead poisoning. After standing several hours in lead pipes, their waters show an average of about 0.2 parts of lead per 100,000. Inquiry fails to show a prevalence of lead poisoning outside of these four towns. There have been occasional cases on other ground water supplies, however. No cases have thus far been found by the board in towns and cities having surface supplies, although many of these waters attack lead. The amounts found in some samples are not inconsiderable, and the lead taken in this manner into the systems of many inhabitants of these cities and towns, may cause mild and unrecognized cases of lead poisoning. The action of water upon service pipes of different materials at Fairhaven, Kingston, New Bedford, West Brookfield and Lowell, was also studied and experiments made. The pipes, which were ⅝-inch in diameter, 45 feet long, and generally lead, iron, galvanized iron and block tin services, were tested. Ordinarily, water was kept flowing through each pipe at the rate of at least one hundred gallons a day. Samples were collected from two to seven times, at different places, through the year, after the water had been allowed to stand in the pipes from one to twenty-four hours. An account of the "Methods Employed for the Determination of Lead, Tin, Zinc and Copper in Drinking Waters," follows the description of the results obtained from the investigation. Regarding the amount of lead that is dangerous to the human system, the general report says:

"While the quantity of lead dissolved may be small, and a single dose might not seriously harm the user of the water, the continued use of water containing lead is harmful, because lead is a cumulative poison. The exact amount of lead which may be taken into the system without producing harm is not definitely known and may vary with different people, but it is known that the continuous use of water containing quantities of lead as small as 0.05 parts per 100,000 or about 1-33 grain per gallon, has caused serious injury to health."

Federal Investigation of Water Supply.

A bill was introduced in the House of Representatives recently, by Mr. Bartholdt of Missouri, which provides for the appointment by the president of three commissioners to investigate such pollution of rivers and other natural sources of water supply as threatens to affect the condition of the people of more than one state. The commission is not to be given any other powers than are necessary for investigating purposes. Its members are to receive $10 a day and expenses, but they are authorized to employ chemical, bacteriological and sanitary experts and other persons in a position to furnish useful information. The total expenses of the investigation must not exceed $30,000, and the report must be submitted to the next session of congress.

Meeting of Municipal Electricians.

A meeting of the executive committee of the International Association of Municipal Electricians will be called soon, at which a program for the next convention of the association will be outlined. The convention will be held in Pittsburg in September, 1900, and it is expected to be an important gathering. Circular letters have been sent out by Capt. William Brophy, Boston, Mass., president of the organization, to the different municipal

electricians of the United States and Canada, asking what they consider the most important problems that now confront the profession.

Rates of a Municipal Lighting Company.

The entire expense of lighting the city of Bay City, Mich., according to a local paper, falls upon the merchants and householders who use electric lights. The city has a municipal plant. With the rates in force the plant is self-sustaining, and the men who own property are charged nothing in the way of taxes for street lighting purposes. Before the city put in its plant the cost was nearly $5,000 per year. Although the private users of the lights are making no objections to the rates charged them, they feel that some charge for street lighting should be assessed against the city at large.

Alley Paving in Ohio.

The Ohio Supreme court has decided that the law enacted some years ago by the Ohio legislature, giving the city of Cincinnati the right to pave the alleys in that city with brick without the consent of the property-owners, was invalid. The decision was rendered in the case of Susan W. Longworth vs. the city of Cincinnati. Her attorneys raised the question that the law was unconstitutional, because it was special legislation, and also that the assessments were made without regard to benefit to abutting property.

A Move for Better Municipal Government.

The Indiana State Board of Commerce will consider at its annual meeting a plan to secure a careful revision of the municipal laws of Indiana with a view to giving the smaller cities and towns better methods of local government.

Information About Electric Lighting.

A report on municipal ownership of lighting plants has been prepared by the special committee of the city council of Richmond, Ind., concerning its investigations. The committee entered into correspondence with the officials of thirty-five cities and towns in the United States asking for detailed information concerning the cost of operating light plants that are owned by cities. Responses were received from Wheeling, W. Va.; Toronto, O.; South Norwalk, Conn.; St. Joe, Mo.; Marion, Ind.; Metropolis, Ill.; Marquette, Mich.; Little Rock, Ark.; Kendallville, Ind.; Muncie, Ind.; Logansport, Ind.; Jamesville, N. Y.; Hudson, Wis.; Hamilton, O.; Gainesville, Ga.; Frederick, Md.; Fremont, Neb.; Frankfort, Ind.; Dunkirk, N. Y.; Decatur, Ill.; Detroit, Mich.; Coldwater, Mich.; Chicago, Ill.; Crawfordsville, Ind.; Council Grove, Kas.; Bloomington, Ill.; Bluffton, Ind.; Bay City, Mich.; Bowling Green, Ky.; Aurora, Ill.; Allegheny, Pa., and Ashtabula, O. It was ascertained from these reports that are street lights cost from $30 to $81 per light per year. The average cost is below $70. Richmond is paying under the contract system $90.

Iowa Paving Assessment Decision.

An opinion was delivered by Judge Eichelberger of Ottumwa, Ia., in the case of A. H. Hamilton et al. vs. the city of Ottumwa et al. The suit was brought to restrain the defendants from the collection of the paving tax levied to pay for the asphalt paving. Judge Eichelberger handed down a second decision Jan. 7, in a case in which the plaintiffs had petitioned the council of Ottumwa to have the paving done with asphalt instead of brick, and upon the old roadbed or grade. The court sustains the demurrer in the case and says, in effect, that if this were a law action brought by the county, the property-owners might be required to pay what it is worth to the street.

Illegality of the Transfer of the Detroit Water Works.

The Michigan supreme court has decided that the act providing for the transfer of the Detroit water works from the water board to the board of public works, and also for various changes in the methds employed to raise money to operate the plant, is unconstitutional. The most important change involved in this act was the abolition of all charges for water used for domestic purposes, and for water closets and wash rooms in buildings not used as residences. The act was declared unconstitutional by the lower court. The supreme court holds that the object of the act was only partially set forth in its title, which related to a change in the control of the works, whereas the act also lays down a new scheme of taxation. It also holds that the act deals with questions of local taxation, which cannot be decided by the legislature without the consent of the voters of the city.

Another Decision Against the Barrett Law.

In an action to foreclose a street lien under the Barrett law, Judge Hord of Greensburg, Ind., held that the law was un-

constitutional, since the law assessed the benefits per lineal foot and not according to the value of the property benefited.

An Engineering Bureau for Philadelphia.

Mayor Ashbridge of Philadelphia contemplates sending to councils a communication suggesting a bureau of engineering. He says that such a bureau now would be of great benefit in the preparation of plans for the improved water supply. As it is now, however, the city's engineers are divided among four or five bureaus, and their services, as a consequence, are not as valuable as they might be made.

Profit-Sharing in a Gas Light Company.

A direct profit-sharing plan has been put in practical operation at a meeting of the board of directors of the Grand Rapids Gas Light Company at Grand Rapids, Mich. The plan is as follows: An employe whose wages are $50 a month will in one year draw $600. As the additional compensation will, for the present, be paid as a cash dividend, the employe will be entitled to the same dividend as a stockholder who has $600 invested. The dividends declared by the company in the recent past have been 3 per cent. on the stock, payable semi-annually, on May 20 and Nov. 20 of each year. The cash dividend received by the above employe will, therefore, be $18 semi-annually. The same rate of dividend applies to all grades of service for the employes, and for the numerous and varied rates of wages. All alike share equally, the basis of the amount of the dividend being the amount of the earnings of the individual employe. It is believed that this policy of treating employes like stockholders, by putting them on the same footing, and treating their investment of labor as equal to stockholders' investment of money, will be an effective remedy for the differences of opinion regarding the rights of labor; that the sense of equality it inspires in them, and the satisfaction of knowing that they share in the prosperity and harmony of the company, is more to them than the dividend. Credit is due Emerson McMillan, president, and the board of directors, for the inauguration of the plan.

Taxation of Electric Light Companies.

A decision was rendered in Common Pleas court No. 4, in the suit of the Columbia Electric Light company against the city of Philadelphia and William J. Roney, receiver of taxes. The city claimed that the company is liable to local taxation, because it is simply a private corporation engaged in the manufacture and distribution of electricity for light and power. Judge Wilson held that the controversy turned upon the legal question as to whether or not the plaintiff corporation is of such a public character that it has had conferred upon it by the legislature of the commonwealth public powers which entitle it to exemption from local taxation, upon the ground that its property, being part of its capital stock, can only be taxed, under the present state of the laws, by the commonwealth directly. In his opinion the entire premises which the city has endeavored to tax are occupied by the plaintiff company, and are essential and indispensable to the exercise of the franchises which were conferred upon it. The plaintiff was, therefore, exempted from the payment of said taxes. He granted the injunction prayed for.

Legal Rate for Gas in San Francisco.

A decision has been rendered by Justice Dunn, of San Francisco, Cal., in the case of the Union Collection company vs. H. G. Cupples, in which he decided that the legal rate that may be charged for gas is $1.50 per 1,000 cubic feet in San Francisco. It is held that previous to July 1, 1899, the legal rate was $1.75, and the resolution of the board of supervisors of April 3, 1899, fixing the rate at $1.10 is declared illegal. The suit was brought in the interest of the San Francisco Gas & Electric company. Cupples, a gas consumer, offered to settle his bill rendered on the basis of $1.10 per 1,000 for gas used since July 10. The company insisted on the $1.75 rate up to July 10, and on the $1.50 rate subsequently. The company's contention was sustained by Judge Dunn.

Raising the Spans of a Bridge.

The work of raising one of the spans of the high bridge and adjusting the rollers on the top of the pier on which the span slides as it expands and contracts with the changes of temperature was completed recently by City Bridge Engineer Munster at St. Paul, Minn. Mr. Munster was obliged to resort to an ingenious method in raising the bridge. He secured two wedges of steel six feet long and having a slanting of one-sixteenth on an inch in eight inches. A heavy car axle was suspended pendulum-wise from the bridge and used to drive the wedges between the bottom of the span and the top of the pier. The hundred-ton span was lifted and the rollers readjusted before the wedges were removed.

Scientific Equipment for a City Engineer's Office.

The street board at Hartford, Conn., decided, Jan. 17, to equip City Engineer Bunce's office with modern scientific instruments for registering the temperature, gauging the rainfall and recording the sewage flow.

Free Tests of Cement for City Engineers.

An offer has been made to city engineers by Edward A. Bond, State Engineer and Surveyor of New York, to test free of charge, at the laboratory of the State Engineer, Albany, N. Y., all cement to be used in municipal public works in the state of New York. These tests will be made for any city engineer or other municipal official in charge of public works, upon receiving properly marked and packed samples complying with the following directions:

1. Samples should be taken from different packages of the lot, say from one barrel or bag in every ten. Each sample should be taken with a long sampling iron reaching to the center of the barrel or bag.
2. The quantity of each sample should be at least 8 ozs., or enough to fill a cubical tin box measuring 3 ins. on each edge. The samples should preferably be put in such boxes, or each may be put in a bag of tough paper, securely tied.
3. The several small boxes or bags should each be plainly numbered, and marked with date, and place and name of structure and name and address of official to whom report is to be sent. They should then be inclosed in a tight box and sent by express, with express charges prepaid, to Edward A. Bond, State Engineer, Albany, N. Y., with a separate letter stating that such samples have been sent. Each barrel or bag from which each sample is taken should also be numbered to agree with the sample numbers.
4. The name of the maker of the cement, or its trademark or brand, may be given or omitted as preferred.
5. The samples will be tested for fineness, for tensile strength, for time of setting and for checking, and will also be subjected to hot water test if desired. In the tests, the rules of the American Society of Civil Engineers will be followed.
6. Samples should be taken and sent at least two weeks before the time when it is desired to receive report of the result of the tests, in order to allow for time in transit, length of test, and mailing of reports of results.

Liability of Directors of a Water Company.

A decision was rendered by Judge Kent, of Frankfort, Ind., Jan. 9, in the suit of J. B. Clow & Co., of Chicago, against John S. Brown, of Crawfordsville, Ind.; E. B. Martindale, of Indianapolis, and the estate of the late R. B. F. Pierce, of Indianapolis. J. B. Clow & Co. furnished the supplies for the Crawfordsville water works system, which was built several years ago, and afterward brought suit against the above named gentlemen, as directors of the water company, claiming that they were liable because as directors they had never collected the capital stock of the concern. After the death of Mr. Pierce his estate was made a party defendant. Judge Kent gave the plaintiffs a judgment for $6,200. The case had been before the supreme court three times.

Opening of the Chicago Drainage Canal.

Water was turned into the Chicago drainage canal Jan. 2, 1900, and the canal was opened Jan. 17. The water power from the drainage canal is to be utilized by the city of Chicago for a municipal electric lighting and power plant, if the city concurs in the agreement arranged by the city electrician, Mr. Ellicott, and the chief engineer of the canal, Isham Randolph. By the terms of the agreement all the water power privileges generated at Lockport by the opening of the canal will be transferred to the city at the rate of $4 per horse power. The lease is for seventy-five years, and the drainage board can take over the plant by paying its cost at the end of that time. The city is to have the free use of the lands of the canal for the power plant and transmission line, while the drainage board reserves the right to use as much power as may be needed for operating bridges and pumping stations, laying only the cost of development. It is estimated that about 20,000 horse power can be developed at the wheels, involving a rental of $80,000 per year, but, as it is estimated that 20 per cent. would be lost in transmission, the power delivered in the city would be about 16,000 horse-power. The estimated cost of developing the power is $3,100,000—electrical equipment, cables, etc., $1,980,000; dams and works at the wheels, $1,120,000. It is estimated that the cost of the power delivered in the city, allowing for interest and other charges, is $14 per horse-power, or $224,000 per annum. The cost of power developed by steam is estimated at $30 per horse-power. The construction of the dams and other work is to be under the direction of the chief engineer of the drainage board. The city is to take all the power developed and to use it for municipal purposes only. It must commence work within ninety days of the signing of the contract and complete it by July 1, 1901. The city can annul the contract within six months, on proper notice. The necessary funds will be raised

by the sale of bonds charged to the water fund, the city claiming that much of the power will be used in pumping water at the pumping station.

Trials of a Municipal Poo-Bah.

A local paper of Gordon, Neb., recently contained the following:

"We understand that the city marshal, James Peterson, has tendered his resignation as marshal, street commissioner, water commissioner and chief engineer. The work of water commissioner entails considerable exposure to dampness, and as Mr. Peterson has experienced a few attacks of rheumatism, he is perfectly willing to relinquish the job to another."

Proposed Amendment of Iowa Paving Laws.

The legislative committee of the Iowa League of Municipalities has prepared an amendment to the present paving assessment law, which will be submitted to the legislature. The imperative need of an amendment to the law has been recognized for some time and, while many of the members of the league have urged radical reforms, the majority favors a slight change in the present law to make it conform to the national constitution and the decision of the federal supreme court. The committee consists of C. E. Campbell, Des Moines, chairman; J. Edward Mushon, Des Moines; John M. Redmond, Cedar Rapids; J. T. Powers, Keokuk; J. F. Devitt, Muscatine; W. M. Bailey, Iowa City; J. H. Quick, Sioux City; Victor Jennings, Council Bluffs, and J. A. Walter, McGregor.

A Farmer Awarded Damages for Exhaustion of His Water Supply.

The appellate division of the New York supreme court handed down an opinion Jan. 9 affirming the judgment of the special term awarding $6,000 damages to Benjamin F. Torbell in his action against the city of New York. Torbell, a farmer owning land in the Twenty-fifth ward, near the Spring Creek pumping station, brought suit for damages on account of the draining off of the underground water supply by the pumps of the city's water works. The case was first tried before Justice W. M. Smith, who decided that the city had no right to take this water and that the farmer was entitled to damages. A number of similar cases are pending against the city and it is believed that the claims for damages under this decision will be practically unlimited. The decision of the appellate division will be carried to the court of appeals.

New City Hall at East St. Louis.

The new city hall at East St. Louis, Ill., was dedicated Jan. 19 and will be occupied at once by all city officials. The new hall replaces the one blown down by a cyclone in 1896.

The Cost of Street Lighting by Naptha.

The attention of the district commissioners at Washington, D. C., has been called by Thomas J. Fisher, district inspector of electric lighting, to the advanced price of naptha or deodorized gasoline, and the consequent bearing of the same, if the present price keeps up, upon the quality, candle power and character of the naptha street lighting for the next fiscal year. At the time bids were received for the present year the price of naptha was about 7 cents per gallon. The price advanced to 11¾ cents and then dropped to the present price of 11 cents. Mr. Fisher says the reason given for the advance is increased consumption and export. The amount of naptha used per year per lamp is approximately 135 gallons, while the price per year for lighting is $6. The lighting contract for the fiscal year 1899 called for a 20 c. p. light, the price paid by the district being $20 per lamp per year. The price of naptha at the commencement of contract, July 1, 1898, was about 6¼ cents a gallon, which made the cost per lamp $14.44. To this was added the cost of repairs, superintendence, equipment of tanks, etc. The contract for the fiscal year 1900 called for a 16 c. p. light at $18.60. Although maintaining a small candle power of four less than previous years, the contractors, it is claimed are using as much, if not more, naptha than was required for a 20 c. p. contract. This is accounted for in some respects by explaining that the burner in use is non-adjustable, and the flow cannot be controlled. The question naturally arises, says Mr. Fisher, what sort of light at $20 per year, the maximum price allowed by law, can be furnished with prices as they are now. From the best information obtainable there seems to be a likelihood of prices remaining close to the 10 cent figure, and Mr. Fisher thinks it well to take the matter up now and look over the field with a view of meeting any exigencies that may arise from this state of affairs.

Competitive Plans for a Bridge.

The government of New South Wales has offered a price of $5,000 for the best competitive design submitted before August 1, for a bridge across Sydney harbor, at Sydney. George W. Bell, United States Consul, Sydney; C. W. Darley, in Ch. P. W. D.

Illegality of Contract for Municipal Electric Lighting Plant.

The Iowa Supreme Court rendered a decision, Jan. 16, annulling the McCaskey-Holcomb contract for the construction of an electric light plant in Des Moines. The city contracted for the building of an electric light plant and was enjoined from carrying out the contract, which contract anticipated the revenues, providing that payments should be made each year until the plant was paid for, when it should become the city's property. The payments were no larger than the city had previously paid annually for light. The supreme court held, however, that a city cannot anticipate its revenues in this way to provide a plant, if the total of anticipated liabilities places the debt above the constitutional limit; that the clause in the contract making a certain per cent. payable each year did not avoid the effect of the constitutional limitation for the reason that the entire obligation to pay was to be created upon the completion of the plant and the fact that it was to be paid in installments did not alter the case so far as the legal effect in regard to the constitution was concerned.

Test of the Legality of Charges for Gas Meters.

The custom of the local light company, Denver, Col., of charging 25 cents a month for each gas meter, has been attacked by City Attorney Ellis, who thinks the charge is illegal. The city attorney had no knowledge of the charge of 25 cents a month for meters until recently, when he moved his home. A gas meter had been installed in the house prior to his occupation of it, but he decided to not burn gas. He was greatly surprised when he received a bill from the company for his meter rental. He refused to pay it and immediately began an investigation of the laws governing meters, with the result that the company will be called upon to defend its position in the courts. City Attorney Ellis will test the legality under quo warranto proceedings in the state supreme court. The Ohio supreme court held, in a similar case, that the prerogatives of the company's franchise were exceeded and that the collection of the charge was illegal.

A Great Topographical Map of New York City.

The topographical map of the city of New York for exhibition at the Paris exposition, has been completed. The map is drawn on a scale of six hundred feet to one inch. Its size is thirty-one feet long and twenty-seven feet wide, and is the largest map ever made of any city in this country. It shows the buildings, contour lines, and delineates the topographical features as well as the development of the city from its beginning to the present time. Legally laid out streets are tinted buff color in the map, while a tentative or preliminary plan of streets in such sections of the city where no official map exists is designated on the map and tinted red. Existing and proposed parks are shown in green. The area of the city and vicinity as shown on the map includes nearly 1,000 square miles. The border of the map is made up of numerous views of the most prominent buildings and the most picturesque parts of the city. While on exhibition the map will lay on a raised platform, especially made and inclosed with a neat bronze railing. In addition to this general map two other maps are in preparation. One map shows the city in 1664 and the other is a topographical map of Manhattan island as it was in 1800. It is the intention to exhibit those maps as a contrast to the general map and to show the wonderful development of New York City within such a short period. These maps and platforms will be forwarded to Paris about Feb. 1, where a space of 1,015 square feet have been set aside for their exhibition in the building allotted to the United States engineering exhibits at the Paris exposition. The sum of $10,000 was appropriated for the preparation of the map. The idea of this exhibit originated with Louis A. Risse, chief topographical engineer.

A Report on Waters Polluted by Chicago.

A report is being prepared by Health Commissioner Reynolds, Prof. A. W. Palmer of the State university, and Prof. E. O. Jordan of the Chicago university which will, they assert, prove that the drainage canal will furnish pure water for St. Louis and the residents of the valley. The report is based upon bacteriological and chemical examinations of more than 10,000 samples of water taken from nearly thirty points along the Illinois and Michigan canal, the Des Plaines, Illinois, Mississippi, Missouri, Sangamon, Fox and Kankakee rivers. The main fact upon which the conclusion is based is that the waters of the Illinois river for miles above its juncture with the Mississippi are purer than are the main tributaries, which proves that the great mass of Chicago sewage now started down the valley undiluted by pure water does not affect the drinking water of St. Louis. A copy of the report will be sent to congress.

Abandoning the Use of Oil Gas.

Mr. J. E. Lohmann, director of public works for the city of Hamilton, O., has recommended to the board of control, on account of the unusual high price of oil, the discontinuance of the manufacture of oil gas and the erection of three benches of five retorts. "While it is true," he says, "that coal has advanced 30 per cent., yet it must be remembered that coal gas gives us residuals in the way of tar and coke. With the additional benches in operation we would have sufficient ammonia to justify the installation of an ammonia condenser which will give an additional product to sell. In 1895 gas oil was $2.50 per gallon; in 1896 gas oil was $2.42 per gallon; in 1897 gas oil was $2.11 per gallon; in 1898 gas oil was $1.59 per gallon. The past few months the price of oil has steadily advanced until now it costs the city $4.30 per gallon, which we readily see is an advance of over 200 per cent. It is, therefore, costing the city over $1,000 per month for oil alone, and the by-product received therefrom yields a low per cent. of very poor tar." Mr. Lohmann's recommendations were concurred in by the board of control.

Technical Meetings.

The fourteenth annual convention of the National Brick Manufacturers' association will be held in Detroit, Mich., Feb. 5-10, 1900. The program will include the following papers: "Construction of Brick Pavements," George R. Grimes, Terre Haute, Ind.; "The Market Side of the Brick Paving Industry," F. B. Stevens, Detroit, Mich.; "The Clay Age," Fritz Wagner, Chicago, Ill.; "Setting Brick in Kiln or Kiln Draft," Warren Iltner, St. Louis, Mo. Hotel Cadillac, which will be headquarters during the convention, will furnish free of charge a suitable room for the exhibiting of light machinery or models, specimen brick, trade literature, etc.

At the annual meeting of the Western Society of Engineers officers were elected as follows: President, Ambrose V. Powell; first vice-president, Edward J. Blake; second vice-president, William H. Finley; treasurer, Ralph Modjeski; trustees, George P. Nichols, August Ziesing and Bion J. Arnold; secretary, Nelson L. Litten. The annual banquet was held at the Grand Pacific hotel. Responses to toasts were given as follows: "Minutes of the Civil Engineers' club of the Northwest," L. P. Morehouse; "The Kansas Bridge in 1869," Octave Chanute; "Municipal Engineering," L. E. McGann; "Opening the Drainage Canal," Isham Randolph; "The Ante-Fire Surveyor," S. S. Greeley; "The Board of Public Works in 1869," W. M. R. French; "Past Presidents," Capt. Robert W. Hunt.

The Engineers' Club of Cincinnati held its twelfth annual meeting Dec. 27, when officers for the ensuing year were elected as follows: President, Thomas B. Punshon; vice-president, William C. Jenett; directors, A. O. Elzner, L. E. Bogen and Alfred Petry; secretary and treasurer, J. F. Wilson.

The annual convention of the Ohio Tile, Brick and Drainage Association will be held in Columbus, O., Feb. 13 and 14.

The Louisiana Engineering Society has elected officers for the ensuing year as follows: H. J. Malochie, president; A. F. Theard, vice-president; Gervais Lombard, secretary; W. H. Hoffman, treasurer; T. L. Raymond, member board of managers; Thomas H. Tutewiler, member board of directors.

At the sixteenth annual meeting of the Civil Engineers' Society of St Paul, Minn., officers were elected as follows: Capt. A. O. Powell, president; A. W. Munster, vice-president; C. L. Annan, secretary; A. H. Hogeland, treasurer; C. A. Winslow, librarian; George L. Wilson, representative on board of managers of Association of Engineering Societies.

Officers have been elected by the Engineers' Society of Western Pennsylvania for the ensuing year as follows: W. A. Bole, president; C. F. Scott, vice-president for two years; Gustave Kaufman, C. B. Albree, directors for two years; R. A. Fessenden, secretary; A. E. Frost, treasurer. The society has started a fund for the purpose of a permanent home.

The American Society of Civil Engineers has elected officers for the ensuing year as follows: President, John Findlay Wallace, Chicago; vice-presidents, Rudolph Hering, New York City, and Alfred Noble, Chicago, each for two years; treasurer, Joseph M. Knap, New York City; directors, John F. O'Rourke and Henry B. Seaman, New York City, district 1; Thomas H. Johnson, Pittsburg, Pa., district 4; Joseph Ramsey, jr., St. Louis, Mo., and Henry B. Richardson, New Orleans, La., district 6; George A. Quinlan, Houston, Tex., district 7, each for three years.

The twenty-second annual meeting of the Illinois Clayworkers' association was held at Ottawa, Ill., Jan. 9 and 10. Officers for the ensuing year were elected as follows: E. J. Hess, Chicago, president; E. M. Heafer, Bloomington, vice-president; G. C.

Stoll, Wheaton, secretary; Lincoln Solfisburg, Aurora, treasurer.

The twentieth annual meeting of the Indiana Engineering society will be held at Purdue university, Lafayette, Ind., Feb. 1, 2 and 3. The program will include the following: "Local Street Improvements—Methods and Results," W. K. Eldridge, city engineer of Lafayette; "Odors and Tastes of Drinking Water," Severance Burrage, Purdue university; "The New East River Bridge," G. L. E. Waesche, instructor in civil engineering, Purdue university; "The Practical Side of Civil Engineering," A. W. Smith, ex-city engineer of Kokomo; "The Sewerage System of Greenfield, Ind.," Will J. Cleary, city engineer of Greenfield; "The Chemist and the Engineer," W. E. Stone, professor of chemistry, Purdue university; "The Engineer and the Contractor," J. F. O'Brien, Cloverdale; "Problems in Practice," J. W. Fawcett, city engineer of Delphi; "A Public Highway Marks the Progress and Degree of Civilization," J. S. Spiker, Vincennes; "Handling and Conveying of Material," R. A. Smart, associate professor of experimental engineering, Purdue university; "Stand Pipe Accidents," W. D. Pence, professor of civil engineering, Purdue university; "The Responsibility of a City Civil Engineer," John Finan, jr., city engineer of Elwood; "Paving Brick and Brick Pavements," D. B. Luten, instructor in civil engineering, Purdue university; "Tile Drainage," L. S. Alter, Remington. W. K. Hatt, associate professor of applied mechanics, will give a laboratory demonstration of strength of materials during the afternoon of Feb. 2. The other laboratories of the university will be inspected that afternoon also. The headquarters of the society will be at the Hotel Lahr, and the sessions of the society will be held in the engineering building.

An Error in Figures.

To the Editor of Municipal Engineering:

Sir—I regret to write you that I have just discovered an error in one of the tables of my yearly report which you were kind enough to publish in your last issue of Municipal Engineering.

In the January number of Municipal Engineering on page 28, second column, in table under "Gas After Asphalt Absorption," heavy hydrocarbons should be 7.2 per cent. instead of 1.2 per cent., and carbon monoxide should be 27.3 per cent. instead of 21.3 per cent. Yours truly,

A. W. DOW,
Inspector of Asphalt and Cements,
Washington, D. C.

The Engineer of the Brentwood Sewage Disposal Works.

To the Editor of Municipal Engineering:

Sir—Your article in the January number of your magazine on the Brentwood, N. H., sewage disposal works was correct in all save one particular, for I was not the engineer who had charge of the construction of the plant or the planning of it. Mr. Amasa S. Glover of Brockton, Mass., had the work constructed under his own supervision. It is of interest chiefly because it is the first sewage disposal works built in this country or abroad, embracing the septic tank and the covered filter, the patents for which are now owned by the American Sewage Disposal company of Boston. Yours, truly, JOHN N. M'CLINTOCK,
President and Manager American Sewage Disposal Company of Boston.

Annual Meeting of the Illinois Society of Engineers and Surveyors.

The fifteenth annual meeting of the Illinois Society of Engineers and Surveyors, held at Moline Jan. 24-26, was very successful, both in its programs and its excursions. The programs were well arranged and a number of excellent papers were presented, such of which as will be of special interest to our readers will appear in following numbers. On Wednesday afternoon questions of legislation were discussed, the paper being by Charles Carroll Brown on the subject of the "Municipal Water Works Commission." He divided the municipal works, the supervision of which has been intrusted to such commissions, into three classes. The first class includes sanitary affairs, such as are now intrusted to State Boards of Health in several states, most of which may properly be placed in the hands of such boards if their membership includes qualified persons of all the professions interested. The second class is the first class extended to include the power to accept or reject the plans for all kinds of municipal improvements, especially for the smaller cities, the board acting not as a consulting engineer, but as an educator of the officials of cities too small to be able to keep in continuous employment competent engineers and as a check upon ill-advised constructions, a municipal works commission with a representative from the State Board of Health, as one member would be more appropriate than an expanded State Board of Health. The third class would include also consideration of financial operations connected with the carrying out of the municipal improvements, questions of franchises and such other operations as are under the control of the British

Local Government Board. It is not probable that American principles of local self-government would ever allot the control of this third class to a state or national board.

Col. Edward Kittelsen, the city marshal of Moline, explained his system of preparing garbage for disposal, and during the excursion of Thursday an opportunity was given to observe the quick and effective manner in which the garbage was cleansed and reduced in amount so that it could easily be disposed of by burial and without offense.

The evening session was devoted to discussions of questions of surveying and roads.

Thursday morning was devoted to reports of the committees on paving brick specifications and tests and on water works. At 10:30 the society became the guests of the citizens of Moline and inspected the new power plant generating electricity for power and lighting; the new bridge across the Mississippi and the new railroad, the government bridge, the United States arsenal, the government water power, the harbor of Moline and the proposed lock to increase its availability, the plow works, and the garbage cleansing plant.

The evening session gave place for a paper on the new Kewanee sewerage system by the city engineer, J. C. Quade. There were also discussions of interest regarding questions of construction, maintenance and records, and a valuable report by the railroad committee presented by E. E. R. Tratman and accompanied by four excellent papers by railroad engineers on various phases of their work.

The meeting closed with a long session on Friday morning with papers on "Economic Railways in Country District" by E. E. R. Tratman, "Some Notes on Electric Light and Power Distribution" by D. W. Mead, and "Municipal Ownership of Combined Electric Light and Water Works Plants" by E. L. Fischer. There were also papers on railroad construction and on the Indicator, which, with special committee reports, made a very full program. This partial statement shows the variety of work of which the society is capable, and its organization, and indicates the value of the society to the profession at large and especially to the state of Illinois.

The officers elected were Charles Carroll Brown of Bloomington, president; H. G. Paddock of Moline, vice-president; W. H. Ketcham of the University of Illinois, executive secretary and treasurer; A. D. Thompson of Peoria, the outgoing president, D. W. Mead of Chicago and J. G. Melluish of Bloomington, trustees. The usual resolutions of thanks were passed and special praise was given to the outgoing secretary, J. A. Harmon of Peoria, for the efficient manner in which he had performed his duties, and much credit is due him for the success of recent annual conventions.

Cost of a Small Municipal Electric Lighting Plant.

John L. Coffin, superintendent of the water department of Asbury Park, N. J., has prepared plans for a municipal electric lighting plant to be operated in connection with the water works. The estimate is for 150 lamps of 2,000 candle power each, and contemplates the utilization of much of the power of the water works, to be supplemented with three 75-light engines and dynamos, at $3,800 each; a 150 h. p. boiler, $2,000; 450 30-ft. poles, $5 each, $2,250; wire, 40,000 ft., $2,400; 150 lamps at $28 each, with irons and hoods, $4,200; engine and dynamo foundations, $1,000; switchboard apparatus, $350; plans and supervision, $400; contingencies, $1,600; total, $25,000. It is estimated that the operation of the plant will require but two additional men, a trimmer and an oiler, and that the cost will be: Interest, $25,000 at 4 per cent., $1,000; depreciation of plant, 5 per cent., $1,250; repairs, $1,000; coal, 4,200 hours, 400 lbs. per hour, $1,800; carbons, 10,000 sets at $38 per 1,000, $380; oil, waste, packings, etc., $240; extra labor, two men at $50 per month each, $1,200; contingencies, $130; total, $7,000 per year. The General Electric company made an estimate of $22,500 for the plant, so that Mr. Coffin's figures may be regarded as liberal.

A Contract for Thirty-Five Million Dollars.

The Rapid Transitt Commission of New York City, on January 16, awarded the contract for the construction, equipment and operation of the proposed new rapid transit railroad to John B. McDonald for the sum of $35,000,000. The road will be largely underground. The project is one of the greatest that has been undertaken in New York. The preliminary work of the commission and the preparation of plans and estimates under the direction of the chief engineer, William Barclay Parsons, has occupied years of time. The road will extend from the City Hall to Kingsbridge, with a branch in the borough of the Bronx and legislative authority will be asked for extending it from the City Hall to the Battery and under the East river to South Brooklyn. The construction will give employment to about 15,000 men, and the con-

tract requires that work shall begin within thirty days. A certified check for $150,000 accompanied each of the two bids, and several surety companies were named as sureties on the bonds, but some trouble has arisen between the contractor and these companies as to the charges of the latter, which may affect the contract, but this is still unadjusted. The next lowest bid was by Andrew Onderdonk and was for $39,300,000. The successful bidder is a Tammany man. He has had large experience. He built the West Shore railroad and the Baltimore tunnel and is now engaged on the Jerome park reservoir, a seven-million-dollar contract. He is a native of Cork, Ireland. He came to this country when fourteen years old, and is now fifty-six years old.

Landscape Architects' Society Dinner.

The annual dinner of the American Society of Landscape Archifetcts was held Jan. 8 at the Hotel Martin. Members of the society were present from Boston, Chicago and other cities. Among the members attending were: John C. Olmsted and Frederick L. Olmsted, jr., and Warren H. Manning from Boston, and O. C. Simonds from Chicago. Among the members from New York City were Miss Beatrix Jones, C. N. Lowrie, Downing Vaux, Samuel Parsons, jr., D. W. Langton, George F. Pentecost and Miss Bullard. The officers elected for the ensuing year were as follows: Prsident, John C. Olmsted, Boston; vice-president, Samuel Parsons, jr., New York; secretary, Downing Vaux, New York; treasurer, C. N. Lowrie, New York. Warren H. Manning of Boston was elected a member-at-large to constitute, with the four officers, the executive committee.

New Publications.

Hydraulic Diagrams for the Discharge of Conduits and Canals, based upon the formula of Ganguillet and Kutter, by Chas. H. Swan, M. Am. Soc. C. E. and Theodore Horton, Jun. Am. Soc. C. E., with a description of the diagrams and their use by Theodore Horton. New York. Engineering News Publishing company.

The title describes the book. The first diagram is one showing the relations between hydraulic inclination, discharge, velocity and size of sewer for circular sewers flowing full from 4 inches to 4 feet in diameter, 0 to 40 cubic feet a second discharge, 1 to 16 feet a second velocity and 1 in 10 to 1 in 10,000 inclination, with the limitations necessary in a rectangular diagram with these limits. With the inclination is given also its fraction of a foot and its square root. The value of n used is 0.015. The second diagram gives the same data for sewers 6 inches to 10 feet in diameter, there being two changes in the scale of discharges to make this range possible in so small a diagram. The third diagram is for sewers 4 feet 6 inches to 20 feet in diameter, discharging 100 to 800 cubic feet a second for appropriate slope. These diagrams are small in scale, being about 4 inches by 5 inches in dimension and have corresponding limitations as to accuracy. They are of great convenience in securing approximate results and in connection with a Colby slide rule will cover all the ordinary cases under the assumptions given.

The diagrams which follow enable one to estimate closely the changes due to change in assumptions. The fourth diagram shows the ratio of discharge for various values of n from 0.008 to 0.018 to that given in the preceding tables for sewers 1, 5, 10 and 15 feet in diameter. Other sizes can be interpolated with fair accuracy.

The fifth to twelfth diagrams give the ratio of discharge, velocity and area for various forms of cross-section running at any depth, to those items for the sewer running full. The cross-sections include the circular, gothic, basket handle, catenary egg-shaped, square, horse-shoe of Wachusett aqueduct and of Croton aqueduct. No diagrams for the flow running full of any of these forms but the first are given.

The last four diagrams give data of a similar nature for canals of rectangular and trapezoidal section.

These diagrams elaborate some given by Coffin in his recent book on this subject and add twelve new ones. They cover sewer work almost as fully as Coffin's diagrams cover water pipe, using another formula. Larger diagrams would be easier to read and less subject to mistakes and would be more satisfactory on this account, if carefully read, for all ordinary cases, and if greater accuracy is needed the diagrams give a close first approximation for use in computation.

The Filtration of Public Water Supplies. By Allen Hazen. Published by John Wiley & Sons, New York City. 321 pp. Price, $3.00.

This is a new edition, the third, revised and enlarged, of Mr. Hazen's treatise on the filtration of water, made desirable by the progressive work in this line since the first appearance of the book five years ago. The last five chapters have been rewritten and elaborated in making the work conform fully to up-to-date knowledge. The book is now about twice as large as it was in the early

form, and is quite profusely illustrated. The author has also added nearly a hundred pages on the operation of filtration plants, including reports on the experimental work in America.

Creosoted Timber; Its Preparation and Uses. Published by the Heywoods, Philadelphia.

This is a book of about one hundred pages, freely illustrated, presenting information as to the utility of dead oil of coal tar as a wood preservative. While commercial purposes prompt its issuance by the Norfolk Creosoting company it contains much information of value on various phases of the subject of testing wood for better preservation.

Municipal Reports.

Municipal Register of the City of Meriden, Conn., for the Year 1899.

This volume embraces the reports of the various council committees and the administrative officers for the year 1899. The street superintendent, J. Edwin Brainard, notes that of the 196 catch basins in use rapid progress is being made in equipping them with a trap or seal to prevent the escape of sewer gas, from which much trouble has been experienced heretofore. The department cleaned 506 basins during the year at an average expense of 66 cents each. To the use of a steam road roller the superintendent gives credit for great economy in the repair of macadam and gravel streets. William C. Mueller, water superintendent, reports an extravagant use of water and that the supply is likely to be inadequate. He recommends the use of meters, which, however, will involve an expense to the city of about $50,000. There is also a large waste of water from leaks in the reservoirs, none of which are capable of holding water. An expenditure of between $75,000 and $100,000 will be necessary to put them in good condition. A particularly valuable feature of the report is a statement by Mr. W. S. Clark, city surveyor, showing the cost in detail of sewers built during 1899 by city labor, and also regarding sewage treated at the filtration beds. The chemical examination and analyses of effluent show that the purification has been up to the standard of previous reports.

Annual Report of the Superintendent of Streets of the City of Cambridge, Mass., for the Year 1899. Chas. A. Brown, Superintendent.

Mr. Brown reports that in cleaning the paved streets it was found that three sweepings a week gave satisfactory results, and that it was found to be advantageous to do the work wholly at night. The general use of waste barrels on the streets was helpful. The increasing amount of macadamizing and repaving makes necessary a new steam road roller, and the superintendent says he does not see how the city can possibly get along another year without one. The superintendent discusses at some length the merits of paving materials and favors the use of brick. This conclusion is based largely on information gathered during a trip to various cities and brick manufacturers last summer.

Annual Report of the Health Officer of the City of Coldwater, Mich., for 1899. T. J. Turner, M. D., Health Officer.

Dr. Turner's report shows a searching consideration of all matters affecting public health. Among the many questions raised by him is a protest against the distribution of samples of medicines which often fall into the hands of small children, sometimes with fatal results. "If these remedies are harmless," he says, "then the sale is a swindle; if not, they are dangerous." The new cement manufacturing industry at Coldwater led to an investigation of the dangers to health associated with this occupation. Dr. Turner says:

"The greatest danger to the health of the cement worker, lies in the fact that the inhalation of the earthly dust, is the presence of a foreign body in the air passages. To what degree of accumulation this collection must attain before decided and demonstrable irritation of the respiratory apparatus becomes evident, I cannot state. That this irritation is frequently evidenced in an acute form is well known to the physicians, but as to the chronicity, that has not come under special observation. When, however, it attains to this degree it exhibits its fatality or will in future, by what was correctly grouped under the term phthisis. Hirt gave the name to this class of diseases, produced by dust of "pneumoconiosis," really meaning from its etymology, 'lung dust disease,' and Zenker gave the name of this special form of dust disease—'chalicosis.' This is the old name for the lung dust disease as it affects cement workers. That the inhalation of this dust is a primary causative factor of tuberculosis may be doubted, but that by inducing and promoting irritation of the respiratory tract it does afford good culture ground for the bacillus of tuberculosis and aids in the tendency towards that disease, cannot be doubted. In the proceedings of the International Medical Congress on tuberculosis, held in Berlin last May, attention was called by Prof. Rubner and Drs. Kreiger and Strattman, to vocations having a determining influence upon the spread of tuberculosis and 'occupations where the lungs become filled with dust' are enumerated as having decidedly and prominently such influence. It is a vocation dangerous to health. One mode of prevention is and has been suggested for the use of cement workers, in the use of what are known as

'respirators' or the use of any apparatus that will arrest the dust, filtering it off, if the expression may be used, from the air before the air is admitted to the lungs.

"Most of these appliances, so far as I am aware and have observed, prove to be annoyances by impeding the respiratory act, as they are placed over the nasal and orai orifices. These means have frequently been tried by firemen in the fire departments for the prevention of the inhalation of smoke. They all more or less interfere with normal respiratory movements and have been virtually abandoned as the materials of which they are constructed soon become hot and moist from the temperature and moisture of the expired air. Total abandonment of the occupation has been followed by recovery from the bronchial and pulmonary irritation; the collected masses of dust being coughed up so that the lungs have recovered their normal functions."

Dr. Turner also notes a common disease among cement workers, resembling eczema, due to the irritating effect of cement dust on the skin.

He also urges legislative steps for preventing the spread of consumption. The increase of the disease is due to the spread of germs in the dried dust of expectoration from diseased persons. Not until proper sanitary precautions are taken against the spread of the disease will there be, he says, a diminution in the number of cases.

Personal Notes.

J. T. Hudson has resigned his position as city engineer at Portsmouth, O.

Henry D. Woods has resigned his position as city engineer at Newton, Mass.

F. E. Swope, city engineer of Beloit, Wis., died recently at Greenville, O.

James Hull has resigned his position as superintendent of the water works at Baraboo, Wis.

Mayor Quincy, Boston, Mass., has appointed Gen. Martin, ex-mayor of that city, water commissioner.

Walter Meiins has been appointed city engineer at Albany, N. Y., to succeed Horace Andrews, resigned.

J. B. Hyndman has resigned his position as superintendent of the Bureau of Bridges at Pittsburg, Pa.

John Flynn, jr., has been appointed engineer in charge of public improvements at Waterford, N. Y.

D. F. Austin was elected city surveyor at Auburn, N. Y., Jan. 1. This is Mr. Austin's seventh term in this office.

Charles F. Knowlton has been reappointed commissioner of public works at Quincy, Mass.

John H. Moffitt has been appointed superintendent of the water department at Syracuse, N. Y.

Gen. A. P. Martin, ex-mayor of Boston, Mass., has been appointed water commissioner of that city.

Benjamin F. Guiney has been appointed secretary of the water board at Detroit, Mich.

W. H. Dean, superintendent of the Dean pump works, Indianapolis, died Jan. 3, aged fifty years.

Alpheus G. Gibbons, ex-mayor of Rahway, N. J., died at his home Jan. 14, aged eighty-seven years.

Fred H. Dean has been appointed superintendent of water works at Baraboo, Wis., to succeed James Hall, resigned.

G. W. Bailey, James L. Bacon and F. A. Smith have been elected members of the board of public works at Pittsfield, Mass.

James H. Fuertes, M. Am. Soc. M. E., has been appointed a member of the board of engineers in connection with the Croton aqueduct, New York City.

Alphonse Fteley, M. Am. Soc. M. E., has resigned his position as chief engineer of the New York aqueduct commission on account of continued ill-health.

W. H. Burns has resigned his position as assistant engineer in charge of the department of roads and pavements at Cleveland, O.

P. P. Evans has been appointed contracting engineer for the King Bridge company of Cleveland, O., in charge of their Boston office.

C. E. Grunsky has been elected city engineer of San Francisco, Cal. The office is a new one created by the new charter which recently went into effect.

John J. O'Hara, who for twenty years has been deputy city engineer of Albany, N. Y., resigned his position, Dec. 31, and has established an office at 93 State-st.

John Wolterstorff has been elected president, John Caulfield secretary and John Lindguist superintendent of the water board at St. Paul, Minn.

John Venner has been appointed superintendent of the water department at Syracuse, N. Y., to temporarily succeed William R. Hill.

Frederic A. Kummer has been appointed general manager of the Eastern Paving Brick company, Empire bldg., New York City.

J. Herbert Grant has been appointed commissioner of public works and George A. Hotchkin superintendent of water works at Rochester, N. Y.

Minard L. Holman, formerly water commissioner of St. Louis, Mo., has been appointed superintendent of the Missouri Edison Electric company, to succeed Herbert A. Wagner, resigned.

William R. Hill, Syracuse, N. Y., has been appointed chief engineer of the New York City aqueduct commission to succeed Alphonse Fteley, who resigned on account of ill health.

Robert Surtees, ex-city engineer of Ottawa, Ont., has been appointed consulting engineer of the government commission appointed to expend $60,000 annually in beautifying the city.

Water Commissioners have been elected recently as follows: Horace Kingman, Brockton, Mass; William B. Littlefield, Lynn, Mass.; Asa T. Lee, Beverly, Mass.; Joseph S. Runner, Holyoke, Mass.

Godd A. Lockwood has been appointed assistant engineer in the department of bridges and Joseph W. Costello and James H. Gudge transmitmen for the department of public work in New York City.

Charles L. Seybold, Baltimore, Md., has

been appointed landscape architect, a new position, taking the place of civil engineer, abolished several months ago. Mr. Seybold has been superintendent of Carroll park for the last eight years.

James W. Milien has been elected president, Herman F. Kallman, vice-president; Robert Y. Ogg, secretary, and James C. Oldfield, chief clerk of the new board of public works, at Detroit, Mich. Marshall H. Godfrey will succeed D. W. H. Moreland as commissioner on the board.

Wilkins & Davidson, Civil Engineers, Pittsburg, Pa., dissolved partnership Jan. 1. Mr. Davidson has become general manager of the Monongahela street railway, while Mr. Wilkins will continue in business at the same location under the name of W. G. Wilkins.

Samuel G. Brosius, Baltimore, Md., has been deprived of his position as superintendent and consulting engineer of the Baltimore water department by the new charter which has recently gone into effect, and which provides for no such office.

John T. MacLeod, C. E., died at his home in Louisville, Ky., Jan. 21, aged sixty-two years. He was receiver of the Kentucky and Indiana bridge company, owner of the big steel bridge across the Ohio, which was recently sold, and owner of the New Albany street railway company.

The interesting and valuable article in this number of Municipal Engineering on "The Relation of Reservoirs to Parks," by Mr. Frederick Law Olmstead, Jr., is published by permission of the American Park and Out-Door Art Association, for which it was originally prepared.

Clifford R. England was arrested in Chicago, Jan. 19, for embezzling $10,000 from the Warren-Scharf Asphalt Paving Company of Detroit, in 1897. He admits his guilt and says that he visited many point of interest in Europe, traveled in Asia, and came back to Chicago by way of San Francisco. He had been living in Chicago for six months.

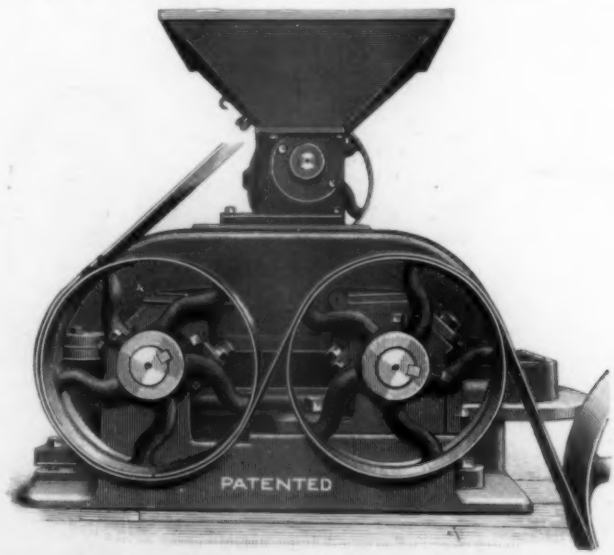
City engineers have been elected as follows: J. W. Wilcox, Macon, Ga., Frank W. Ormsby, re-elected, Oswego, N. Y.; George W. Bell, Kingston, N. Y.; Huber B. Caral, Putnam, Conn.; George A. Wetherbie, re-elected, Malden, Mass.; F. C. Kelsey, re-elected, Salt Lake City, Utah; B. F. Darling, White Plains, N. Y.; Charles R. Felton, Brockton, Mass.; George Bowers, Lowell, Mass.; Edward H. Smith, Lynn, Mass.

Mr. and Mrs. S. Dana Greene were drowned, Jan. 8, while skating on the Mohawk river, near Schenectady, N. Y. Mr. Greene was a son of the late Commander Samual Dana Greene, who was second in command of the Monitor when she fought the Merrimac, and was a nephew of Gen. Francis V. Greene of New York City. Mr. Greene was given a military education, but soon after graduating he became active in electrical business and at the time of his death he was general sales manager of the General Electric company.

MACHINERY AND TRADE.

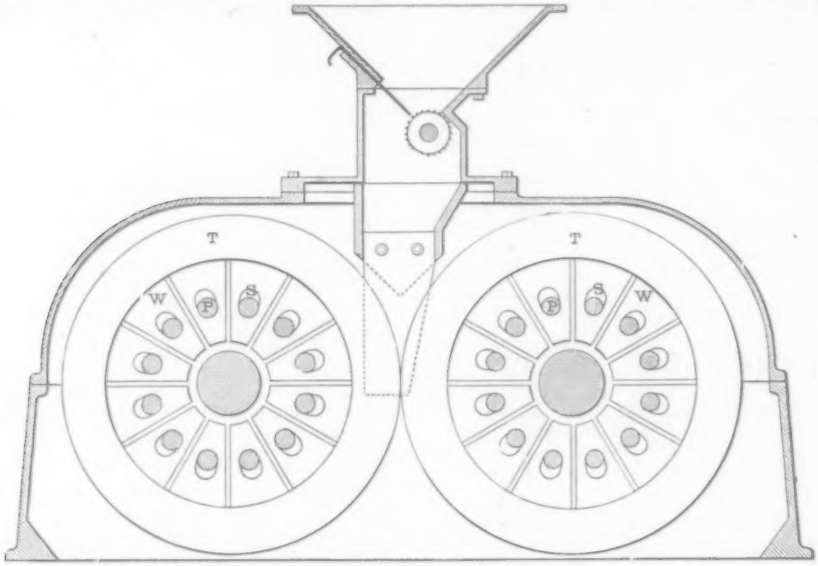
Centrifugal Rolls.

Centrifugal rolls are so named because they alone crush by utilizing the immense centrifugal forces generated by their rotations. No springs are needed to force the roll faces together, and, although the space between the tire faces opens and closes as in common rolls, yet in centrifugal rolls neither shaft, nor roll, nor bearing has any backward or forward movement. For these



reasons no crushing push can be transmitted to the roll shafts. These entirely escape the direct shocks, and the pounding caused by the backward and forward movements of the heavy common roll and its roll. The segment weights are prevented from giving expanding pressures to the tire by strong steel hub flanges.

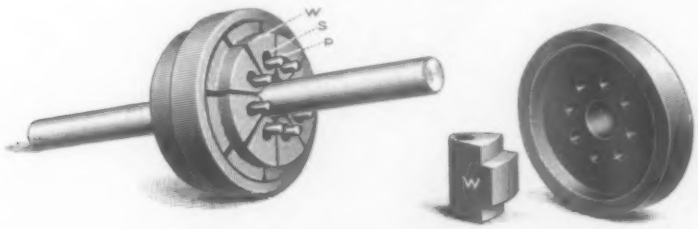
The slots (S) permit each weight to move back on its pin toward the shaft, but its



bearings. Centrifugal rolls have also the singular property of automatically balancing themselves. They, therefore, run with nearly the steadiness of dynamos. Since the output of common rolls is directly as their peripheral velocities, centrifugal rolls, which easily run three times as fast as

backward movement can transmit no push to the shaft. It is plain that the weights (W) in running hold the tire in position by the immense power of centrifugal force.

The tires in a pair of rolls can only be pushed back toward their shafts by a superior force, and as no rock is strong



other rolls of equal size, should have three times their capacity, and as a matter of fact their output exceeds such estimates.

The centrifugal roll consists of but three important parts, viz.: the shaft, the segment weights (W) and the tire. The segment weights together in operation form a roll, over which is placed the tire. Each weight is held to the shaft flanges by the pin (P) passing through the weight slot (S). Each weight rotating with the shaft is set out by centrifugal force, and together the weights form, as before stated, a strong

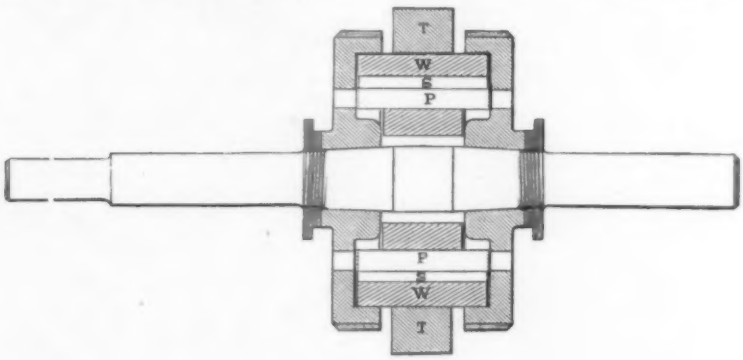
enough to exert such force it is easily crushed. If a bit of uncrushable steel gets between the rolls, and forces back the tires and weights, no harm is done, for no crushing shocks are transmitted directly to either shaft. The roll shafts are not pressed back at all.

This action may be illustrated by a weight rotated from a shaft by a cord. The weight may easily be pushed back, but no push can be transmitted to the shaft. It is thus seen that if centrifugal roll faces are set

as closely together as wanted no springs are needed to keep them in position.

Centrifugal rolls, balancing themselves, run easily at all speeds. In the large sizes very moderate speeds give to centrifugal rolls ample crushing power. All rolls benefit by high peripheral speeds, but while common rolls cannot run fast, centrifugal rolls can, and thus they have marvelous effectiveness without large diameters.

Small centrifugal rolls do extraordinary work. Those of even moderate size do more and better work than the largest common rolls that can be constructed. They run easily, as shown in the illustration, with small driving pulleys, and they require so much less power than slow-running common rolls that no balance wheels are needed. Centrifugal rolls of very moderate dimensions do work enough. Being smaller, it is claimed that they cost less in fuel, less to transport, less to set up, less to run and less for repair parts, which are all comparatively small.



The James J. Mahony Patent Catch Basin Filter Trap.

James J. Mahony of Akron, O., who has had much experience in sanitary sewerage work, has invented a catch basin filter trap which has been tested in Akron under the charge of a committee of the Akron sewer department and members of the Akron Board of Health. This test was made in one of the Akron streets where conditions were such as to give it a severe trial. The particular place where the test was made had been causing trouble for years by stagnated water and sewer gas coming up in the catch basin until the Board of Health was called on to remedy matters. Mr. Mahony claims that his patent "does not require half the attention in all seasons of the year that others do," and that it is not necessary to use large quantities of salt in winter weather, as is done in connection with other methods, the trap seal being so low the frost has no effect on the water and the warm end of the sewer connection helps to prevent freezing. It is claimed that the patent protects a sewerage system, as nothing but water can get into the sewer, that all water is removed from the basin, leaving it perfectly dry in all seasons of the year, and that thus the clean basin does not admit of any stagnant water, filthy odors or sewer gas, and that the trap is not only water-tight, but absolutely self-cleaning. It is guaranteed not to get out of repair. The patentee offers to send blue prints and estimates of cost to those interested in the use of the device.

Of Interest to Users of Grinding Machinery.

Manufacturers who use grinding machinery will be interested in a translation of the opinion of the official patent office expert in Germany on tube-mill patents. This opinion has been printed in pamphlet form for English readers by F. L. Smidth & Co., who control the Davidsen tube-mill patents and are now suing manufacturers who use infringing machinery. The opinion gives a very clear exposition of the subject, with illustrations. It is suggested that possible trouble can be saved to those who are interested by timely investigation of the matter. Copies of the pamphlet can be obtained from F. L. Smidth & Co., 66 Maiden-lane, New York City.

Trade Notes.

ASPHALT.

An aspahlt deposit situated near Tampico, Mex., is about to be developed, according to an Associated Press report under date of Jan. 29. It is owned and will be operated by Mexicans, who have refused offers from American contractors for operating it.

The Barber Asphalt Paving company, 11 Broadway, N. Y., is reported as having purchased all the principal asphalt deposits in Mexico. These deposits have been worked

by the company in a small way for several years. The most extensive deposit is located near Soto La Marina river, Tamanlipas, for which the company paid $300,000 in gold. Other deposits purchased by the Barber state of Vera Cruz, south of Tampico. Extensive asphalt plants will be established.

The American Oil and Asphalt company, Los Angeles, Cal., has been incorporated by S. Abbott, W. E. Dunn and A. Crutcher of Asphalt Paving company are located in the Los Angeles.

CEMENT.

Preparations are being made by the Portland Cement company at Milton, N. D., to run night and day.

The Altborne Brick and Cement company, Ltd., is being organized in Essex, England, to manufacture brick and Portland cement.

A cement plant is contemplated at Texarkana, Tex., according to press reports.

A new Portland cement plant is proposed at Caledonia, N. Y.

A new Portland cement plant will be erected in Parley's Canyon, near Salt Lake City, Utah. Arnold G. Gianque, Salt Lake City, is interested.

The Wabash Portland Cement company, Wabash, Ind., has acquired buildings and land at Howard City, Ind., a new town on the Wabash R. R.

The establishment of a cement factory at Gate City, Ala., is contemplated by western capitalists. T. G. Bush of Birmingham, Ala., is said to be interested.

An option has been granted certain promoters on 200 acres of land belonging to Henry C. Cook at Momer, Mich., for the erection of a cement plant.

The Lawrenceville Cement company, New York City, has purchased 130 acres of cement land near Easton, Pa., and contemplates the erection of a Portland cement plant.

The Silica Cement Manufacturing and Mining company, Trenton, Md., has been incorporated by J. W. Avery and Osborne Congleton of New York and H. G. C. Thornton of Jersey City.

The Arkansas Portland Cement company, Texarkana, Ark., has been incorporated by T. A. Whitmore, president; Sam Lazarus, vice-president; E. Kirby Smith, secretary and treasurer.

The Northwestern Hydraulic Cement and Stone company, Minneapolis, Minn., has filed articles of incorporation. Fred Sheridan, L. P. Van Norman, George Williams and H. H. Coleman are the incorporators.

The Peerless Portland Cement company, Union City, Mich, desires to purchase some clay grinding machinery to grind a strata of sand gravel and rock containing 15 per cent. water, and shale containing 8 per cent. water, according to press reports.

The establishment of a plant for the manufacture of Portland cement at Bergen, N. Y., is contemplated. A. D. Coffin of Oldfield, N. Y., holds options on 300 acres of land under which rich marl beds are located.

The Indiana Portland Cement company has been incorporated in New Jersey. The office and plant of the company will be at Milford, Ind., where 1,400 acres of marl lands have been secured. P. F. Miles, Milford, is vice-president.

A plant for the manufacture of Portland cement will be established by the Baltimore & Ohio railroad company as soon as the most favorable site along its route shall be determined. John H. McDowell is subjecting the clay and limestone beds through which the railroad passes to a thorough chemical examination.

Capitalists of York County, Pa., and Baltimore, Md., are organizing a company, to be known as the Peachbottom Cement, Tile and Brick company, to manufacture cement, brick and tile from slate refuse of the quarries near Delta. The principal office will be in Baltimore.

Contracts will be let for the proposed cement plant of the Peninsula Portland Cement company, at Woodstock, Mich., as soon as the plans and specifications are completed. The Osborne company, Cleveland, O., will design and superintend the construction of the plant.

A cement plant is being built in the north end of Winnipeg, Man., by Sampson Walker.

The Dillon Cement company of Goshen, Ind., has been incorporated with officers as follows: President, C. W. Miller; vice-president, A. J. Irwin; secretary, J. W. Replogle; treasurer, D. W. Neidig. The directors of the company consist of the above named officers and J. F. Rieman and Milo Meredith.

The Edison Portland Cement company, Stewartsville, N. J., has purchased land valued at about $54,560 in the vicinity of Stewartsville and Newvillage. This represents a little more than one-half the real estate the company will use, and the plant will be one of the largest in the country. Thomas A. Edison is at the head of the company.

The American Cement company of Pennsylvania, the Unites States Building Material company of New York, Lesley & Trinkle of Philadelphia, and others have been consolidated under the title of the American Cement company of New Jersey. The properties acquired include cement lands in three states, five mills in Egypt and Coplay, Pa., one on the Erie canal at Jordan's, N. Y., and established and profitable agencies in New York, Boston, Philadelphia and Baltimore.

Warsaw, Ind.—The Indiana Portland Cement company is preparing to erect a large cement mill at Milford, Ind. The plant will be one of the largest in the country, and will have, at the outset, a daily capacity of 1,500 barrels, and the machinery will be so arranged that with but little additional expense, it can be converted into a capacity of 2,500 barrels daily.

A pocket memorandum book has been issued by the Charles Warner Co. of Wilmington, Del. The first ten pages contain a condensed statement of valuable information regarding lime, cement, sand and crushed stone, which makes it very useful to those who are interested in these materials.

The German-American Portland Cement company, Chicago, Ill., has been incorporated by E. E. Prussing, R. A. Wildowson and R. E. Ross.

SEWER PIPE.

The State Line Sewer Pipe company's plant at East Liverpool, O., is offered for sale.

The Williams, Moore & Stone Sewer company, Bonham, Tex., has been incorporated by A. J. Moore, F. B. Williams, G. W. Stone and others.

The Knowles, Taylor & Anderson Sewer Pipe company, Liverpool, O., has an order for 75 car loads of sewer pipe for the con-

struction of a sewer in Allahabad, situated in the Northwest Province of India, near the holy city of Benares.

The Sanitary Sewer company, Philadelphia, Pa., has been incorporated by J. H. Cromie, jr., of Camden, N. J., and G. S. Wertmer of Philadelphia, Pa.

An extensive sewer pipe plant will be erected at Mogadore, O., by a stock company, in which George T. Whitmore and Chas. H. Palmer will be principally interested.

The Union Sewer Pipe company, Red Wing, Minn., held its annual meeting recently and re-elected the former directors and officers. C. E. Sheldon, secretary and treasurer.

BRICK.

The Barry Vitrified Brick Works, Atchison, Kas., will purchase new machinery and a dryer.

The DeHaven Brick company, Altoona, Pa., is about ready to begin turning out paving and building brick.

The entire output of the Scranton Vitrified Brick & Tile company, Scranton, Pa., will be taken in the immediate vicinity this year.

The Mack Manufacturing company, New Cumberland, W. Va., contemplates running several of its paving brick plants during the entire winter.

The Batavia Brick & Tile Works, Batavia, O., which have been in operation under a receiver, have been ordered sold Feb. 1 by the court. The works have been appraised at $25,000.

A clay bed, comprising twenty acres, well adapted for making brick, has been located just outside of the city limits of Hot Springs, S. D., in which Indianapolis parties are said to be interested.

Vitrified brick of the finest quality have been made from samples of shale obtained from Le Loup, Kas., and a company will be formed to put the product on the market. The vein of shale was discovered on the farm of the Rev. James Murray of Baldwin.

The Ferris Brick company, Mechanicsville, N. Y., has been incorporated to manufacture paving brick, pressed front brick, hollow brick, tile and other clay and shale products. The directors of the company are J. C. Duncan, H. O. Bailey and E. H. Strong of Mechanicsville and H. S. Harp of Green Island.

A new artificial stone has been invented in Germany for paving purposes, which is a mixture of pit coal and brimstone, heated, making a half liquid mass, to which chloride of lime is added. This is allowed to cool when it is broken up into small pieces, to which finely broken slag is added. The mixture is then pressed into briquettes at a pressure of 200 atmospheres. It has been successfully tried as a paving material in streets where traffic is heavy and constant.

The Knowles, Taylor & Anderson sewer pipe plant has been purchased by Charles A. Smith of East Liverpool, O., for $65,000.

The Des Moines Brick and Manufacturing company, Des Moines, Ia., contemplates rebuilding its big plant at W. Thirtieth-st. and the Rock Island tracks next year, and it is probable that it will burn its brick with gas instead of coal.

The Terre Haute Brick and Pipe company, Terre Haute, Ind., has devised a new pattern for a paving block which will, it is believed, become popular with railroads for use in the construction of station platforms. Orders have been placed by the Vandalia, Terre Haute and Logansport railroads for enough blocks to build station platforms at Greencastle and Logansport.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Bloomington, Ind.—The Indiana Supreme Court decided Jan. 11 in favor of building a free turnpike along the road leading from this city to Bedford.

Clinton, Ia.—About twenty-five suits have been commenced in the district court to prevent the collection of paving assessments and it is believed that more than one hundred more suits will be filed.

Baltimore, Md.—City Commissioner W. W. Varney has notified the Consolidated Gas company that it will be required to pay 25 per cent. of the total cost of repairs to city streets in the future.

Philadelphia, Pa.—Special attention has been recently given to brick paving for city streets by Director of Public Works Haddock, with the result that the requirements for this class of work have been raised higher than heretofore.

Pontiac, Ill.—The Supreme Court has granted the Talbot Paving company permission to file a petition for a mandamus against the mayor and city council of this city to compel them to pass a new ordinance for the pavement constructed by the company under the old ordinance, which was declared invalid.

CONTRACTS TO BE LET.

Fairview, N. J.—Bids are asked until Feb. 7 for grading, etc. F. B. Wallace, Boro. Clk.

Orange, N. J.—Bids are asked until Feb. 5, for flagging the sidewalks of Cleveland-st. R. Rodman, Chmn.

Winnipeg, Man.—Bids are asked until Feb. 7, for supplying about 1,000 cords of cedar paving blocks. C. J. Brown, Cy. Clk.

Jacksonville, Ill.—Bids will be received about Feb. 10 for 20,000 sq. yds. of brick paving. C. W. Brown, Pub. Engr.

Cincinnati, O.—Sealed bids will be received until Feb. 7 for building a road with broken stone. Geo. H. Spellmire, Clk. B. C. A.

Missoula, Mont.—Bids are asked until Feb. 5 for building a road around the Delong Branch. A. P. Tietjen, Chmn. Bd. Commrs.

Mount Holly, N. J.—Bids are asked until Feb. 6 for building three 8-in. macadam roads. Howard Mathis, Dir. Board Chosen Freeholders.

Cleveland, O.—Sealed proposals are asked until Feb. 6 for paving Grant, Hancock and

Maple-sts. with brick. John Vandervelds, Dir. Pub. Wks.

Toledo, O.—Bids are asked until Feb. 19 for paving Hicks-st. from Washington-st. to Forest-ave. with brick or block. William O. Holst, Cy. Clk.

Michigan City, Ind.—(Special.)—Bids will be received until Feb. 26 for paving Wabash-st. with brick, from Berton-st. to Barker-ave. H. M. Miles, Cy. C. E.

Evansville, Ind.—Sealed proposals will be received until Feb. 10 for building brick sidewalks during the year. Geo. W. Swearingen, Clk. B. P. W.

Texarkana, Ark.—((Special.)—Bids will be received until Feb. 20 for improvements and curbing in improvement district No. 3 B. M. Foreman, Chmn. Bd. Commrs.; A. B. Matson, C. E. and Surveyor.

Baton Rouge, La.—Sealed bids will be received until Feb. 1 for paving the sidewalks on Main, Florida, North Boulevard and St. Ferdinand-sts. with brick. Robt. A. Hart, Mayor.

Wabash, Ind.—Sealed bids are desired, according to press reports, for 22,000 sq. yds. of sheet and block asphalt paving and 14,000 lin. ft. of combined curb and gutter. Robt. P. Woods, Cy. Engr.

Chicago, Ill.—Bids are asked until Feb. 13 for about 3,105 sq. yds. asphalt paving, four new catchbasins, five electric switches and insulators and lamp poles set. E. G. Schubert, Secy.

Galveston, Tex.—Sealed bids will be received until Feb. 15 for furnishing paving brick, common brick, Portland cement, broken stone, sewer pipe, etc. Geo. L. McCracken, Sec'y B. P. W.

Newport News, Va.—Sealed bids will be received until Feb. 19 for paving Washington-ave., Twenty-fifth-st. and River Road with asphalt, brick, block, asphalt block or granite block. Jas. F. Hughes, Chmn. St. Com.; J. A. Massie, Cy. Clk.

Oil City, Pa.—Sealed bids are asked until Feb. 12 for 8,000 sq. yds. of brick paving on 6-in. Portland cement on Seneca-st.; 1,700 sq. yds. brick paving in Harriott-ave.; repairing Main-st. and two blocks of N. Petroleum-st. with brick. G. F. Roess, Cy. Engr.

CONTEMPLATED WORK.

Flint, Mich.—Paving is contemplated for Harrison-st.

Geneva, Ill.—Paving is contemplated for Wilson-st.

Washington, Ia.—Paving is proposed for the public square.

New Orleans, La.—Asphalt paving is proposed for Lafayette-st.

Independence, Mo.—The question of paving is being discussed.

Marinette, Wis.—Brick paving will be constructed on Hall-ave.

Canton, O.—Plans are being prepared for paving several streets.

Moline, Ill.—Petitions will be circulated for paving Sixth-ave.

Quincy, Ill.—The estimated cost of paving Twelfth-st. with brick is $30,400.

Toronto, Ont.—Brick paving is urged for Dundas-st., from Bloor to Humberside.

Racine, Wis.—Bids will be advertised soon for macadamizing Washington-ave.

Trenton, Mo.—Brick paving is being agitated for this city by the press.

Bayonne, N. J.—The question of street improvements is being discussed. Mayor Seymour.

Youngstown, O.—Paving is contemplated for Market-st., from the viaduct to Warren-ave.

Winnipeg, Man.—Brick and granite block paving for the principal streets is contemplated.

St. Paul, Minn.—Ordinances have been approved for asphalt paving for four streets.

Topeka, Kas.—Brick paving is proposed for about fourteen blocks of E. Eighth-st.

Boulder, Col.—Union-st., from Liberty-st. to the Vandalia road, will be paved.

Norwalk, O.—A resolution has been passed to pave Main-st. T. P. Kellogg, Cy. Clk.

Norwalk, O.—Main-st., from Woodlawn-ave. to Church-st., will be paved with brick.

Greenville, Ill.—The paving of the public square is favored by Mayor DeMoulin.

London, Ont.—The Board of Works decided Jan. 18 to construct cement sidewalks only.

Saginaw, Mich.—Plans are being prepared for paving Lapeer-st. with brick. Wm. B. Baur, Mayor.

Easton, Pa.—The survey of the Delaware river road will begin about Feb. 1. A. J. Cooper, Co. Engr.

Joliet, Ill.—Resolutions have been ordered prepared for paving Lincoln-st. with asphalt.

Baltimore, Md.—Specifications are being prepared for paving Bank lane with asphalt blocks.

Kansas City, Mo.—Ordinances have been recommended for paving Twentieth-st. and Elmwood-ave.

Meriden, Conn.—An appropriation of $10,000 has been voted for permanent pavement or macadam.

Worcester, Mass.—Asphalt or granite block paving is contemplated for a portion of Main-st.

Woburn, Mass.—The question of issuing $100,000 street improvement bonds is being discussed.

Bellefontaine, O.—Contracts may be let in March for brick or asphalt paving. John R. Cassidy, Mayor.

Kansas City, Mo.—An effort is being made to revive the plan for constructing the Admiral-st. boulevard.

Savannah, Ga.—The paving of certain streets with brick is recommended by Mayor Myers in his annual report.

Springfield, O.—Paving, curbing and sidewalks have been recommended for several streets. Cy. Engr. Sharon.

Red Oak, Pa.—The question of paving several of the principal streets of this town is being agitated.

Moscow, Ida.—The question of paving the streets in the business part of town is being agitated.

Spokane, Wash.—The preliminary work preparatory to paving First-ave., from Madison to Washington-st., has begun.

Portsmouth, Va.—A bill has passed the legislature authorizing the issue of paving and grading bonds.

Portland, Or.—The bids received for paving Twenty-first-st. have been rejected and will be readvertised.

Plainfield, N. J.—Extensive street improvements have been recommended by the committee on streets and sewers.

Watertown, N. Y.—Asphalt paving is recommended for several streets by Mayor Porter in his message.

Dayton, O.—A resolution has been passed to pave Sixth-st., from Ludlow to Canal. F. M. Turner, Cy. Engr.

Bristol, Tenn.—A resolution has been passed providing for the paving of several streets with brick.

Pendleton, Or.—Considerable street work is contemplated for this year by the Street Committee.

Alton, Ill.—Petitions are being circulated for brick paving on Union-st., from Henry to the Vandalia road.

Belvidere, Ill.—A petition has been received asking for asphalt paving for State-st. Wm. H. Moore, Mayor.

St. Paul, Minn.—New specifications have been prepared for paving Farrington and Sherburne-aves. with asphalt.

New Haven, Conn.—A petition to pave Crown-st., from Temple to State-st., with brick is being circulated.

Stockton, Cal.—The residents of the Third ward propose to bond this city for $150,000 for street improvements.

Spokane, Wash.—City Engineer Weile has expressed himself as being in favor of brick paving for Sprague-ave.

Wilmington, N. C.—Vitrified brick paving is proposed for two to six blocks. Hugh McRae, Chmn. Sts, and Wharves Com.

St. Louis, Mo.—Ordinances for the reconstruction of Morgan, Seventeenth, Washington and Garrison-sts. with asphalt were approved Jan. 13.

Sherman, Tex.—An experiment will be made with vitrified brick paving on E. Houston-st., between the Court House square and Branch-st.

Grand Rapids, Mich.—A resolution has been introduced to pave Canal-st., from Pearl to Trowbridge, with brick, sheet or block asphalt.

Milwaukee, Wis.—The Board of Public Works has decided to construct considerable asphalt paving, according to local press reports.

Alton, Ill.—The village board of Upper Alton passed an ordinance, Jan. 19, to pave Garden, Manning and College-aves. with brick.

Atlanta, Ga.—An additional $10,000 for paving Peters-st., $5,000 for Decatur-st. and $2,500 for Edgewood-ave., has been appropriated by the City Council.

Delray, Mich.—The question of paving River Road, through this place, with cedar blocks on concrete, is being considered. St. Com'r Alexander.

Butte City, Mont.—Resolutions have been passed for paving and curbing in districts 11, 12, 13, 14, 15, 16, 17 and 18. J. P. Callan, Cy. Clk.

Carrollton, Mo.—The question of constructing about 50,000 sq. yds. of brick and macadam paving is being considered. J. E. Lynn, Sec'y St. Com.

Orange, N. J.—A resolution to flag and reflag the west side of Lincoln-ave., between Main-st. and Central-ave., will be taken up at the February meeting.

La Crosse, Wis.—The common council approved plans, Jan. 21, for forty blocks of brick paving. Bids will probably be asked about April 1.

Peoria, Ill.—The estimated cost of paving the levee at the foot of Main-st., and replacing piling along the dock line is $30,000. A. D. Thompson, Cy. Engr.

St. Joseph, Mo.—The business men along Missouri-ave., in S. St. Joseph, will petition for the paving of that thoroughfare. Both brick and asphalt are favored.

Brooklyn, N. Y.—Ordinances have been approved for paving Schenck-ave., between Livonia and New Lots, with asphalt, and between Livonia and Atlantic-ave. with trap rock.

The question of issuing bonds for street improvements will be voted on as follows: Oswego, N. Y., $100,000; Connellsville, Pa., $15,000; Allegheny, Pa.; Parkersburg, W. Va.

Wabash, Ind.—The council has decided to receive bids immediately for paving Hill-st. its entire length, 1¼ miles, with asphalt: estimated cost, from $50,000 to $60,000.

Waukegan, Ill.—The petitions for paving Julian, West and Genesee-sts. and Grand-ave. have been favorably acted upon and objections to the proposed improvements will be acted upon Feb. 3.

Zanesville, O.—The bids received for paving Marietta road were rejected Jan. 8 and the assistant city engineer was instructed to amend the plans and specifications and readvertise the work.

Elmira, N. Y.—A bill will be sent to the legislature providing for a special election to vote on the question of issuing $50,000 a year for 5 years for constructing pavements and sidewalks.

Aurora, Ill.—An ordinance will be introduced in the council for paving S. La Salle-st. with asphalt, with cement curb and gutter. Petitions are being circulated for paving for a number of streets.

Bay City, Mich.—The estimated cost of paving First-st. with vitrified brick is: Property-owners, $16,856.52; street and alley crossings, $5,642.61; street railway, $4,359.53.

Wapakoneta, O.—(Special.)—Specifications are being prepared for 6,500 sq. yds. of brick paving on Auglaize-st., and for about 9,000 sq. yds. of brick or asphalt on W. Auglaize-st. Samuel Craig, Cy Engr. and Co. Surv.

Chicago, Ill.—A public hearing was given Jan. 24 on paving the following streets: Oakley-ave., asphalt; Walnut, Forquer and W. Polk-sts., and Fullerton and portion of Wentworth-aves. brick; portion of Wentworth-ave. and Cass-st., granite.

Chicago, Ill.—Commissioner McGann has asked for nearly $13,000,000 for public improvements. Of this amount $3,110,000 is for new bridges and viaducts. The estimated cost of widening Michigan-st., paving with asphalt and building new sidewalks, is $63,596.

Denver, Col.—Plans were adopted Jan. 9 for macadamizing Water-st. An ordinance has been recommended to pave Logan and Grant-aves., from Sixth to Eighth, with macadam. A petition has been presented to the Board of Public Works asking that York-st. be paved with asphalt.

Lakewood Hamlet, O.—(Special.)—R. J. Wood, C. E., says bids will be asked about the middle of February for improving Clifton Boulevard, by grading, draining and curbing, as follows: Curbing, 45,000 ft. 7x20 in.; draining, 10,000 ft. 18-24 in. pipe; grading,

200,000 cu. yds. excavation; estimated cost, $95,000.

Bloomington, Ill.—(Special.)—The commissioners of highways of Bloomington township solicit correspondence from contractors for parties having or controlling quantities of first-class road materials. Send prepaid samples of such materials addressed to the engineer of the board, J. G. Melluish, Bloomington, Ill., with information as to locality, quantities and prices.

Indianapolis, Ind.—The city engineer was instructed, Jan. 19, to prepare papers for cement sidewalks on Wolcott-st., from Vermont to Michigan. Resolutions were also adopted for paving an alley with brick and cement sidewalks and curbing in several streets. The city engineer was instructed, Jan. 24, to prepare papers for asphalt paving and cement walks on Bird-st., from Ohio to New York, and paving an alley with brick, and cement walks in Meikel-st., from McCarty to Ray. Papers were ordered prepared, Jan. 26 ,for brick paving in Court-st., from Liberty to Noble, and asphalt paving in Shelby-st., from Pleasant Run to Raymond-st. Cement walks with stone curbing are petitioned for in Madison-ave., from Palmer to Iowa.

CONTRACTS AWARDED.

Pendleton, Ind.—The contract for paving with brick the principal streets of this town has been awarded to Oscar Hardin.

Fresno, Cal.—Grading contracts were awarded, Jan. 16, as follows: I-st., A. R. Brooks, $1,482; O-st., A. R. Brooks, $381.

Spokane, Wash.—Contracts for most of the proposed paving in this city has been let to the Alcatraz Paving company, according to press reports.

Ft. Worth, Tex.—The contract for paving the Al Hayne triangle with brick has been awarded to Brown & Dabney at $1.75 a sq. yd.

New Orleans, La.—The contract for paving Girod and Julia-sts. with granite block was awarded, Jan. 9, to Joseph A. Craven, $1.05 and $1.45 respectively.

Brooklyn, N. Y.—The contract for 6,775 sq. yds. of granite paving on filled in land at Wallabout basin was awarded, Jan. 5, to the Asphalt Construction company for $11,-125.

Bonnville, Ind.—The contract for improving about 4,000 ft. of Third-st., by paving with macadam has been awarded to McCulla & Wylie of this city at $1 per running foot.

Cleveland, O.—Bids were received Jan. 18 from more than ninety contractors for paving fourteen streets with brick. The council has asked for time to consider the bids owing to the advance in prices.

Toronto, Ont.—Asphalt paving contracts have been let as follows: Bernard & Brunswick-aves., Construction & Paving company, $13,687; Palmerston-ave., Warren-Scharf Asphalt Paving company, $11,045.

New Yorw City—Bids were received Jan. 11 for asphalt paving on present foundations on Thirty-third, Eighty-fourth, One-hundred-and-twenty-ninth and Twenty-eighth-sts. The prices for asphalt paving exclusively on the streets were: Atlantic Alcatrez Asphalt company, Thirty-third-st., $2.89; Eighty-fourth-st., $2.85; One Hundred and Twenty-ninth-st., $2.85; Twenty-eighth-st., $3.223. Sicilian Asphalt Paving company, $2.85 for the two streets and $2.93 and $3.09 respectively for other streets. Warren-Scharf Asphalt Paving company, $2.87, $2.82, $2.97 and $3.27 respectively. Fruin-Bambrick Paving company, $2.89, $2.92, $2.95 and $3.29. Barber Asphalt Paving company, $2.95, $2.85 and $3.35. Asphalt Construction company, $2.95 and $2.72. Uvalde Asphalt company, $2.78, $2.95 and $3.25.

Alleghany, Pa.—Contracts were awarded Jan. 9 as follows: Grading, paving and curbing Superior-ave., A. V. Purnell, $16,850; Melrose-ave., $13,141, and Wabash-ave., $20,769, Booth & Flinn, Ltd. Jas. McAfee also received the contract for a portion of Wabash-ave., for $19,103.

Buffalo, N. Y.—Bids were received Jan. 10 for repairing Ellicott-st. as follows: G. W. Partridge, brick, $2,850; H. P. Burgard, brick, $3,150, and asphalt, $3,029; German Rock Asphalt and Construction company, asphalt, $2,987; Barber Asphalt Paving company, asphalt, $2,975; American Contracting company, asphalt, $2,885.

St. Paul, Minn.—Paving contracts were awarded Jan. 16 as follows: Broadway, from Seventh to Grove-st., brick, $11,720 for city's portion and $7,630 for street railway tracks; Ninth-st., from Broadway to Locust-st., $8,400, and Waconter-st. from Seventh to Ninth-st., brick, $3,987, Jas. Forrestal company. Bids were received Jan22 for paving a portion of Waconter-st. with sandstone on concrete, but the contract was not awarded.

SEWERS.

CONTEMPLATED WORK.

Newburyport, Mass.—It is proposed to issue bonds for new sewers.

Cranford, N. J.—The extension of the sewerage system to Garwood is proposed.

Bridgeport, Conn.—Contracts will probably be let about March 1 for $25,000 of sewers.

Ballard, Wash.—The establishment of a complete sewerage system is contemplated.

Oshkosh, Wis.—Final action will be taken Feb. 1 for the Nineteenth-st. sewer.

Marshalltown, Ia.—The question of sewage disposal is again being agitated.

De Kalb, Ill.—A system of sewers is being designed by Alvord & Shields of Chicago.

Wakefield, Mass.—This town is preparing to enter the Metropolitan sewerage system.

Athens, Ga.—A sewer on Lumpkin-st. is proposed by Cy. Engr. Barrett.

Joliet, Ill.—A petition is being circulated for a sewer on S. Ottawa-st.

Media, Pa.—The question of a sewerage system is being discussed.

Wellsville, O.—Plans have been adopted for a storm water sewer.

Hamilton, Ont.—The issue of $75,000 bonds for building three sewers is being considered.

Chicago, Ill.—A sewer in Columbus-ave., from Seventy-fifth-st. to Clarksdale, is contemplated, at a cost of $34,800.

Beaver Falls, Pa.—An ordinance is pending to borrow $55,000 for a complete sewerage system.

Kansas City, Mo.—Plans are being prepared for more than 6 mls. of sewers. Cy.

Engr. Wise.

Aberdeen, S. D.—The city council has decided to build a sewerage system at a cost of about $10,000.

St. Bernard, O.—The cost of a sewerage system is estimated at $200,000 by Jas. A. Stewart, vil. engr.

Lexington, Ky.—A 24-27-in. pipe sewer, 4,300 ft. long, is contemplated. Mayor Duncarand.

Duluth, Minn.—Petitions will be presented to the council for sewers in Garfield-ave. and Nelson-st.

Frederick, Md.—A proposition to build a sewerage system has been submitted by Willard C. Keller.

Walla Walla, Wash.—The proposed sewerage system will be built by day labor and under the direction of an expert.

Emmetsburg, Ia.—Charles P. Chase, C. E., Clinton, Ia., estimates the cost of a sewerage system for this town at $10,000.

Reading, Pa.—The finance committee has reported favorably on the proposed loan of $100,000 for sewerage and paving.

Brooklyn, N. Y.—Plans for an elaborate system of sewers have been completed; estimated cost, $2,500,000.

Canton, S. D.—S. B. Howe, city engineer at Sioux Fall, S. D., will make plans for a sewerage system for this town.

Brookfield, Mo.—Plans are being made for sewers in district No. 4. Hiram Phillips, St. Louis, Mo., cons. engr.

Wilmington, N. C.—A resolution has been adopted to appoint a committee to secure plans for a severage system.

Grand Rapids, Mich.—City Engineer Ames estimates the cost of sewers as follows: E. Godfrey-ave., $5,767; Hall-st., $17,250.

Houston, Tex.—The advertisement of bids for building the proposed sewerage system has been authorized.

Seattle, Wash.—A sewerage system on the eastern slope of Renton Hill is contemplated; estimated cost, $35,000.

Hamilton, O.—Plans and specifications for sewers in Tenth and High-sts. will be made by the city engineer.

Belleville, Ill.—Surveys for the proposed Richland Creek sewer, 2¼ mis. long, have been completed. Louis Greiner, cy. engr.

The construction of sewerage systems is contemplated at the following places: Kent, O.; Lead, S. D.; Manchester, Vt.; Cape May, N. J.

Bay City, Mich.—The recommendation of the board of public works for a 26x39-in. main brick sewer in Third-st. has been approved by the council.

Milwaukee, Wis.—A bond issue of $50,000 is pending in the council for extending the Thirtieth-st. tunnel from North-ave. to Center-st.

Pomona, Cal.—W. H. Sanders, cy. engr., estimates the cost of the proposed outfall sewer and sewer farm at $28,160.

York, Pa.—The mayor has approved an ordinance providing for a loan for establishing a sewerage system and disposal plant.

Nashville, Tenn.—Mayor Head has recommended that the legislature be asked to authorize this city to issue $500,000 bonds for new sewers.

East Hampton, N. Y.—Engineer Barnes of this village has asked for a franchise to build and maintain a comprehensive sewerage system.

Lakewood Hamlet, O.—(Special.)—The proposed sewerage system will be voted on in February; estimated cost, $150,000. R. J. Wood, cy. engr.

Pittsfield, Mass.—An order has been passed by the aldermen directing the mayor to appoint a committee to solve the sewage disposal system.

Ridgefield, N. J.—The state sewerage commission has approved the plans for a combined sewerage system for the village of Ridgefield Park.

Louisville, Ky.—The construction of sewers estimated to cost $614,000 is recommended by City Engineer Parsons in his annual report.

Dayton, O.—A resolution has been passed authorizing the construction of about 10 miles of 12-8-in. pipe sewers and a pumping station; estimated cost, $49,000. F. M. Turner, cy. engr.

Worcester, Mass.—Harrison P. Eddy, supt. sewers, estimates that $564,774 will be required to complete the several branches of the separating sewerage system.

Wilmington, Del.—Alderman C. W. Worth, H. P. Wert, J. H. Hanby and Hugh McRae have been appointed a committee to consider the question of sewerage. Mayor Waddell.

The question of bonding for sewers and sewerage systems has been favorably voted on as follows: Greenville, O.; San Francisco, Cal.; Everett, Wash.

Irvington, N. J.—A resolution has been adopted providing that if the joint sewerage system cannot be speedily secured, that action will be taken to establish an adequate system.

Grand Junction, Col.—Hiram Phillips, C. E., St. Louis, Mo., will prepare plans and specifications for a sewerage system for the Grand Junction Training School. T. G. Lemon, supt.

Syracuse, N. Y.—In his annual report R. R. Stuart, city engineer, recommends that action be taken at once toward the improvement of Onondaga Creek and Harbor Brook, and the construction of intercepting sewers.

Camden, N. J.—The advisability of building a number of large sewers for the purpose of draining the meadow land south of Mechanic-st. and west of Eighth-st. is being considered; estimated cost, $40,000.

Galesburg, Ill.—Plans for a new sewerage system have been completed. The main sewer will be 14 ft. wide and 9 ft. 3 ins. high, and the branches will be 66 to 48 ins. in diameter; estimated cost, $250,000. M. J. Blanding, cy. engr.

The question of issuing bonds for building sewers and sewerage systems will be voted on as follows: Waynesburg, Pa., Feb. 20; Greenfield, Mass., sewer; York, Pa.; Ithaca, Mich., Feb. 9; Norwood, O., Feb. 19, sewer extension; Hartwell, O.; Carlisle, Pa.; Beaver Falls, Pa., Feb. 20; Conemaugh, Pa.

Long Island City, N. Y.—Bills have been sent to the legislature for sewer improvements in the Borough of Queens, one calling for the construction of disposal works and an outlet for the Jamaica sewerage

system, and the other for a sewerage system at Elmhurst; estimated cost, $94,000 and $50,000 respectively.

CONTRACTS TO BE LET.

Roswell, N. M.—Bids are asked until March 13 for a trunk sewer. B. Hammett, jr., clk.

Wichita, Kas.—Bids will be received until Feb. 26 for the construction of sewer district No. 2.

Martinsville, Ind.—Sealed bids are asked until Feb. 9 for a sewerage system.

Harrisonburg, Va.—Bids are asked until Feb. 12 for about 5,200 ft. 15-6--in. pipe sewers. D. M. Switzer, mayor.

Newburgh, N. Y.—Sealed bids are asked until Feb. 6 for a lateral sewer in E. Third and South-sts. Edwin W. Fiske, mayor.

Oil City, Pa.—Bids will probably be received Feb. 12 for about 1,500 ft. 12-in., 900 ft. 15-in. and 729 ft. 18-in. pipe sewer. G. F. Roess, cy. engr.

Bayonne, N. J.—Sealed proposals are asked until Feb. 6 for building a sewer in W. Ninth-st. W. C. Hamilton, cy. clk.

Martinez, Cal.—Sealed bids are asked until Feb. 13 for extending the Castro or Smith-st. sewer about 1,500 ft. M. H. Hurley, town clk.

Bloomfield, N. J.—Bids are asked until Feb. 5 for a stoneware pipe storm sewer in State, Broad and Almira-sts. John A. Lawrence, chrmn. sewer com.

Atlanta, Ga.—Sealed bids are asked until Feb. 5 for building sewers and furnishing sewer pipe, cement, castings, catch-basins, etc. D. G. Wylie, comr. public wks.

Wilkesbarre, Pa.—Bids are asked until Feb. 7 for building a sewer along the line of Bowman Spring river, known as route No. 1. Sterling R. Catlin, chrmn. sewer com.

Ft. Wayne, Ind.—Sealed proposals will be received until Feb. 19 for the construction of a main intercepting sewer, consisting of 12,840 lin. ft. of 5-ft. internal 3 ring bricker sewer, and 3,100 lin. ft. 4-ft. internal diameter 2 ring brick sewer. A. M. Schmidt, clk. b. p. w.

CONTRACTS AWARDED.

Seattle, Wash.—Stiratt & Goetz secured sewer contracts on Ray-st. and Third-ave., W. $5,888.

Santa Monica, Cal.—C. L. Powell, Los Angeles, was awarded a contract, Jan. 15, for a sewer for $4,148.

Kearney, N. J.—The contract for building a sewer in Forrest-st. was awarded to Edward Sargent.

New York City—B. J. Sullivan, 220 Broadway, secured the contract, Jan. 10, for a sewer in Kirkside-ave. for $14,684.

Salisbury, N. C.—The contract for building a sewerage system was awarded to C. W. Bunkhaller & Co. of Birmingham, Ala.

St. Louis, Mo.—The contract for building a sewerage system has been awarded to McIntyre & Tees for $20,000.

Ft. Wayne, Ind.—Bids were received, Jan. 18, from Joseph Derheimer & Co. and Austin Rieg for vitrified pipe sewers.

Passaic, N. J.—Froast & Finnegan, Garfield, N. J., secured the contract for a sewer in North Passaic for $16,000.

Williamsport, Pa.—Robert Stucker, Harrisburg, Pa., secured the contract, Jan. 11, for house sewers on Arch-st. and Dewey-ave. for $8,585.

Waycross, Ga.—The contract for furnishing four miles of sewer pipe was awarded, Jan. 12, to Montague & Co., of Chattanooga, Tenn.

Cincinnati, O.—The contract for 1,350 feet of 3½ ft. brick sewer and 2,400 ft. 12-18 in. pipe sewers was awarded, Jan. 16, to M. T. Flynn for $10,468.75.

St. Cloud, Minn.—Bids were received for the upper ravine stone arch sewer, as follows: Carl Stroop, $4,354; Gruber & Co., $4,421; Arnold Granite company, $4,600; John Heimann, $4,625; Joseph Marsolck, $5,967.

WATER-WORKS.

Helena, Mont.—This city voted, Jan. 18, to bond for $600,000 to buy or build a water works plant.

The question of municipal ownership of water works is proposed at Cicero, Ill.; Homer, Mich.; Valley Junction, Ia.; and Fulton, N. Y.

Cedar Rapids, Ia.—Judge Shiras of the federal court granted an injunction Jan. 25 to prevent the city from putting into force a recently passed ordinance reducing the water rates.

Jersey City, N. J.—Mayor Hoos has called an election for Feb. 13 to vote on the question as to whether this city is to bond itself for $7,595,000 to purchase the proposed new water supply, which is being constructed at Boonton, N. J., by P. H. Flynn.

Newly incorporated water companies: Bergen County Water company, Kearny, N. J.; South Shaon Water company, South Sharon, Pa.; Millinocket Water company, Bangor, Me.; Dunbar Water Supply company, Philadelphia, Pa.; Century Water company, Pittsburg, Pa.; Allegheny Mountain Water company, Altoona, Pa.

CONTRACTS TO BE LET.

Ponca City, Ok. Ter.—Bids are asked until Feb. 6 for furnishing the machinery for water works. C. H. Ogden, Cy. Clk.

Ada, Minn.—Sealed bids will be received until March 1 for building a water works system. Frank H. Calkins, Vil. Rec.

Chico, Cal.—Bids are asked until Feb. 7 for a franchise for supplying water and electric light. Richard White, Cy. Clk.

Starkville, Miss.—Sealed bids will be received until Feb. 19 for building a water works system. Hall & George, Engrs.

Wilkinsburg, Pa.—Bids are asked until Feb. 15 for constructing a 10,000,000 gal. reservoir. Jas. H. Harlin, Pres't and Engr.

Waco, Tex.—Bids are asked until Feb. 15 for a 25 h. p. gasoline engine and one power lead pumping engine. Bell Water company.

Geneva, N. Y.—(Special.)—Bids are asked until Feb. 18 for the construction of a 10,000,000 gal. reservoir; estimated cost, $10,000. E. Seybolt, Supt.

Collinwood, O.—Sealed bids are asked until Feb. 25 for about 2½ mis. 12 in. and ½ mis. of 8 in. water pipe. A. J. Thieman, Chmn. Lgt. and Water Com.

Chicago, Ill.—Sealed proposals are asked until Feb. 9 for furnishing boiler breechings, and until Feb. 10 for six live steam purifiers for the Central Park-ave. pumping station. L. E. McGann, Com'r Pub. Wks.

Cleveland, O.—Sealed bids are asked until Feb. 15 for building the foundations of an

engine house, boiler and coal storage house, and chimney, including aqueduct, pump wells and screen wells for the Kirtland-st. pumping station. Walter P. Rice, Dir. Pub. Wks.

Cincinnati, O.—Bids are asked until March 9 for the construction, delivering and erection of 4 self-containing, vertical, triple-expansion, crank-and-fly wheel, pumping engines, and until Feb. 23 for castiron pipe and special castings for the settling reservoirs near California. Aug. Hermann, Pres't W. W. Com'rs.

CONTEMPLATED WORK.

Grand Rapids, Mich.—The installation of a filtering plant is generally favored.

Slatington, Pa.—The borough council has decided to build a pumping station below the reservoir.

River Rouge, Mich.—Maps and surveys for a water works system will be made by Mason L. Brown of Detroit.

Alton, Ill.—The mayor has been directed to employ an engineer to estimate the cost of the water plant, according to press reports.

The question of bonding for water works has been favorably voted on as follows: Kilbourn, Wis.; St. Michaels, Md.; Wills Point, Tex.; Hampton, Minn.

Little Rock, Ark.—Hiram Phillips, C. E., St. Louis, Mo., recommends the laying of larger mains in the principal streets.

Denver, Col.—An ordinance was passed, Jan. 4, authorizing the issue of $4,700,000 for the purchase or construction of a gravity pressure water works system.

The question of issuing bonds for water works will be voted on as follows: Phoenix, Cal.; Two Rivers, Wis.; Douglas, Ga.; Batavia, O.; Hyattsville, Md.; Elyria, O.; Monmouth, Ill.

Richmond, Va.—A settling basin and filter is recommended for the water supply of this place by Prof. Mallet of the University of Virginia and Dr. E. C. Levy of this city.

Philadelphia, Pa.—Council has authorized the work necessary for the extension, improvement and filtration of the supply of Belmont, Roxborough and Forrestdale; also a loan of $3,200,000 for that purpose.

The construction of water works systems is contemplated at the following places: Milton, Wis.; Clarksville, Tex.; Baker City, Or.; Piqua, O.; Westfield, N. J.; Morehead, Ky.; Belchertown, Mass.; Alcester, S. D.; Yazoo City, Mass.; Corydon, Ia.; Spencer, Mass.; Chittenango, N. Y.

BRIDGES.

Kane, Pa.—Bids are asked until Feb. 21 for a bridge over the P. & E. R. R. tracks.

Coldwater, Mich.—A number of iron bridges have been recommended by I. D. Miner, Co. Surv.

Sioux City, Ia.—Plans will be made by the city engineer for a bridge over Floyd river at Fourth-st.

Oswego, Kas.—Bids are asked until Feb. 6 for iron bridges to be built over Varing creek. Co. Clk.

Scranton, Miss.—Bids are asked until March 5 for building a steel and iron bridge. Frank H. Lewis, Clk.

Wellsville, O.—Bids will be received until Feb. 14 for a new steel bridge at the east end of town. Co. Comrs.

Hamilton, Mo.—The county engineer has been directed to prepare estimates for a steel bridge over Dry Fork creek.

Cincinnati, O.—The city engineer has been directed to proceed with the plans for the new Harrison-ave. viaduct.

Knobnoster, Mo.—Bids are asked until Feb. 8 for seven iron and combination highway bridges. Geo. T. Gallagher.

Dassel, Minn.—Bids are asked until March 17 for a tubular steel bridge across Collinwood Lake creek, section 25. Co. Comrs.

Hartford, Conn.—Bids are invited until Feb. 6 for a steel lattice bridge and repairing a bridge. B. F. Wamples, Co. Audt.

Grand Rapids, Mich.—Bids are to be submitted not later than Feb. 23, according to press reports, for a bridge at Bridge-st.

Cleveland, O.—City Engineer Ritchie has been authorized to ask for bids for the steel superstructure for the Wilson-ave. bridge.

Wausau, Wis.—The city engineer has been directed to prepare plans for a bridge across the river from McEachron's Mill to the Island Mill.

Wilkesbarre, Pa.—Bids will be received until Feb. 24 for two stone arch bridges over Dorranceton and Kingston ponds. H. S. Smith, Engr. in Ch.

Lakewood Hamlet, O.—(Special.)—A bridge is contemplated over Clifton boulevard, carrying the Nickle Plate R. R.; estimated cost, $11,000. R. J. Wood, C. E.

Chicago, Ill.—Plans are being prepared for bridges over the Chicago river at Division-st., Clybourne-place, Weed and Ninety-fifth-sts. Cy. Engr. Ericson.

St. Paul, Minn.—Plans are being prepared by City Bridge Engineer Munster for a new bridge to replace the one that now crosses the Great Northern tracks on Western-ave.

Rockford, Ill.—D. W. Mead, C. E., Chicago, has prepared plans for the new North Town bridge. Bids will be asked as soon as a plan has been definitely settled upon.

Scranton, Pa.—The question of issuing $167,526 bonds for a viaduct on the south side of W. Lackawanna-ave., over the tracks of the D., L. & W. R. R., will be voted on Feb. 20.

Vincennes, Ind.—Sealed bids will be received until Feb. 7 for steel highway bridges. J. S. Spiker, Engr. in Ch.; J. D. Williams, Co. Audt.; Fred Samonial, Prest. Co. Comrs.

Cleveland, O.—Bids will be received until Feb. 7 for a masonry arch under Superior-st., at Rockefeller park, and two masonry arches over Dean brook, at Wade park. Bd. Bd. Com'rs.

PARKS.

Lincoln, Neb.—A free park is proposed.

Chicago, Ill.—Plans for another south side park have been submitted to the council's committee on streets and alleys.

Philadelphia, Pa.—The park commissioners have asked for an appropriation of $100,000 for park work during 1900.

Seattle, Wash.—The council has accepted sixty-two acres of land in Madison-st., near Lake Washington, to be used for a city park.

Ft. Wayne, Ind—North Side park, one of the finest pleasure resorts in this city, has been named Lawton park in honor of Gen. Lawton.

Anderson, Ind.—The Union Traction company has purchased 160 acres of land north of Fortville and along the line to Indianapolis and will convert it into a beautiful park.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

New Castle, Pa.—A garbage furnace is proposed.

Meadville, Pa.—The Board of Health has recommended the erection of a garbage crematory.

Altoona, Pa.—The railroad company has agreed to lease a site to this city on which to build a garbage plant.

Canton, O.—John Schroyer is chairman of a committee appointed to investigate plans for a garbage disposal plant.

Newport News, Va.—A bill has been passed authorizing an issue of bonds for the establishment of a garbage disposal plant.

Mt. Vernon, N. Y.—The contract for the removal of ashes and garbage for two years has been awarded to Henry Fink of this city for $6,000.

Peoria, Ill.—Alderman E. S. Kearjeas is reported as securing information regarding the collection and disposal of garbage. H. W. Lynch, Mayor.

Indianapolis, Ind.—The Board of Public Works awarded the contract for sweeping and cleaning improved streets during 1900 to Chas. H. Stuckmeyer at 18½ cents per 10,000 sq. ft. each cleaning.

St. Paul, Minn.—The committee has adopted the recommendations to put all work of street cleaning under the department of O. Claussen, Cy. Engr. Further investigation of street cleaning, garbage disposal, etc., will be made.

Wilmington, Del.—The contract for collecting garbage has been awarded as follows: First district, Geo. C. Slaughter, $5,400; Second district, Martin F. Keough, $7,950; Third district, Henry Witsil, $9,100; Fourth district, Jas. J. Riley and Daniel McCornock $15,000.

Atlanta, Ga.—This city has adopted the system of garbage cremation invented by Frederick W. Dennis, 145 Walton-st., Atlanta, who sold his rights in this country to parties who are now operating the system. The Lester Furnace company has the contract at $1,000 per month.

STREET LIGHTING.

Racine, Wis.—Bids will be asked for lighting the streets.

Abbeville, La.—Jas. Maxwell may be addressed regarding an electric light plant.

Hamilton, O.—Bids will be received Feb. 12 for constructing gas works.

Anderson, Ind.—The city council has voted $20,000 to improve the electric light plant.

Gentry, Tenn.—Bids are asked until March 1 for an electric light plant. W. A. Jared.

Chambersburg, Pa.—The enlargement of the municipal electric light plant is contemplated.

Elmira, N. Y.—The Elmira Illuminating company has been awarded the contract for street lighting.

The question of issuing bonds has been favorably voted on as follows: Chaska, Minn.; LaCrosse, Wis.

Tarboro, N. C.—Bids are asked until Feb. 22 for an electric light plant. Geo. Howard. Prest. B. P. W.

Collinwood, O.—Bids are asked until Feb. 25 for an electric light light. A. J. Sherman, Chmn. Lgt. Com.

Alliance, O.—Permanent action will be taken Feb. 1 toward the establishment of an electric lighting system.

Braintree, Mass.—An appropriation of $26,000 has been voted for remodeling the eletric light plant.

Norfolk, Va.—The contract for an electric lighting plant has been awarded to L. L. Leich & Sons of Chicago for $73,371.

Tallahassee, Fla.—Bids are asked until Feb. 13 for an electric light plant. F. W. Armstrong, Chmn. Elec. Lgt. Com.

Bedford, Pa.—A contract has been made with the local light company for thirty 2,000 candle-power arc lights for $1,875.

Evanston, Ill.—A large 500,000 electric light plant, to operate between this city and Waukegan, is proposed.

Monticello, Ark.—Sealed bids will be received until Feb. 10 for an electric light plant. R. L. Hardy, Secy.

Ada, Minn.—Sealed bids will be received until March 7 for an electric light plant. Frank M. Calkins, Vil. Rec.

The question of issuing bonds for electric lighting plant will be voted on as follows: Shippensburg, Pa.; New Wilmington, Pa., Feb. 20.

Elkader, Ia.—The question of granting a 20 yr. franchise to Schmidt Bros. & Co. for an electric light plant will be voted on Feb. 13.

Electric lighting plants are contemplated at the following places: Collinwood, O.; Morehead, Ky.; Elbow Lake, Minn.; Bluffs, Ill.; Yonkers, N. Y.

Manchester, Ia.—A franchise has been granted A. L. Beardslee for five years for 100 lights of 16 c. p. and 8 lights of 32 c. p., at $12 per light per year.

Owensboro, Ky.—J. M. Nevitt, F. A. Ames, G. Delker and M. Cary have been appointed a committee to investigate and report on the feasibility of erecting an electric light plant.

Washington, D. C.—A bill was introduced in the House, Jan. 23, to reduce the price of arc lights in the District to $60 per annum and electric current from 12 cents to 6 cents per kilowatt.

A bill to authorize cities to procure control and ownership of water works, gas works or electric light plants by the purchase of shares of stock, and to provide for their management, is before the Mississippi Legislature.

Washington, Ind.—The city council purchased, Jan. 9, the local electric light plant, paying $67,000; $10,000 for a three years' franchise; $32,050 for interest and cost of incorporation into a company; total, $109,050.

Albion, Mich.—A contract has been awarded the Albion Electric Light company for three years. The contract calls for 62 arc lights of 1,200 c. p., of which 57 are 1 o'clock and 5 are all night lights, at $45 and $60 per year respectively, or $2,865 annually.

Indianapolis, Ind.—D. M. Parry, who owns the franchise for an electric light and power service outside of the "mile square," has asked permission to erect poles and string wires in the north part of the city, to provide for domestic as well as commercial wires.